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Improved Punching and Drop Press.

The above named firm have long been known to the mechanical public through their excellent drop presses and punching presses, which have been widely used in the manufacture of silver and plated ware, spoons, watches, silver and brass ornaments, lamps, tin ware, copper bottoms, metallic kegs, and the endless variety of goods made of sheet metal, and in forging for general machine purposes, carriage parts and clips, lock work, gun parts, plane irons, table cutlery, agricultural implements, carriage spring heads, steel traps, tinmen's tools and machines, bolt headings, etc.

Recent improvements upon these tools have features which warrant us in directing the attention of manufacturers to them, as probably yet unexcelled specimens of machines of their class.

Fig. 1.

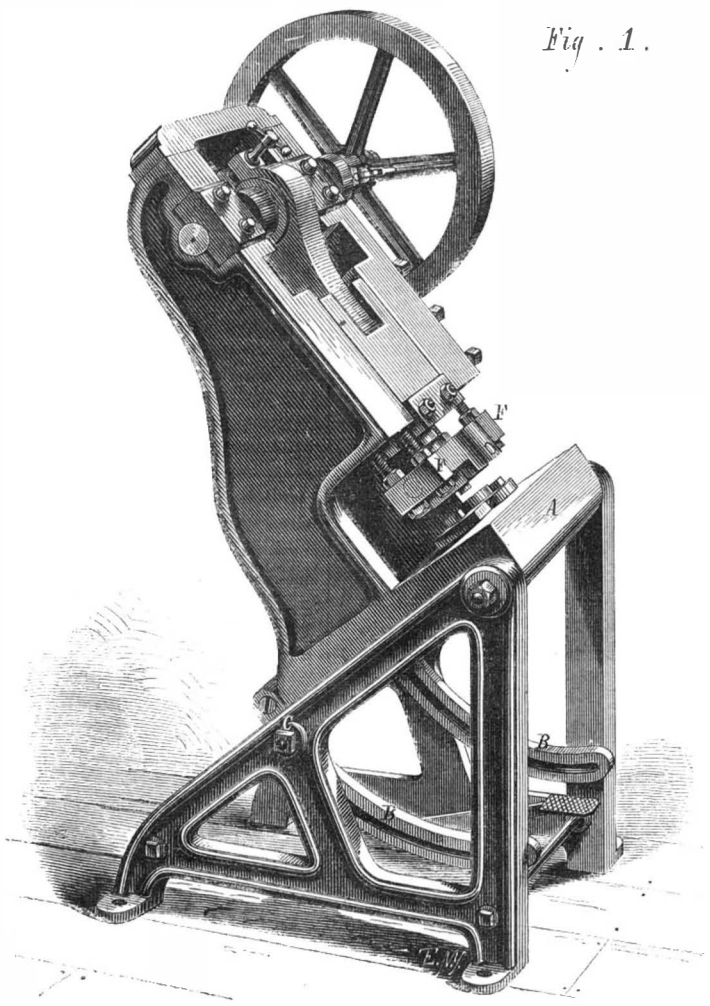
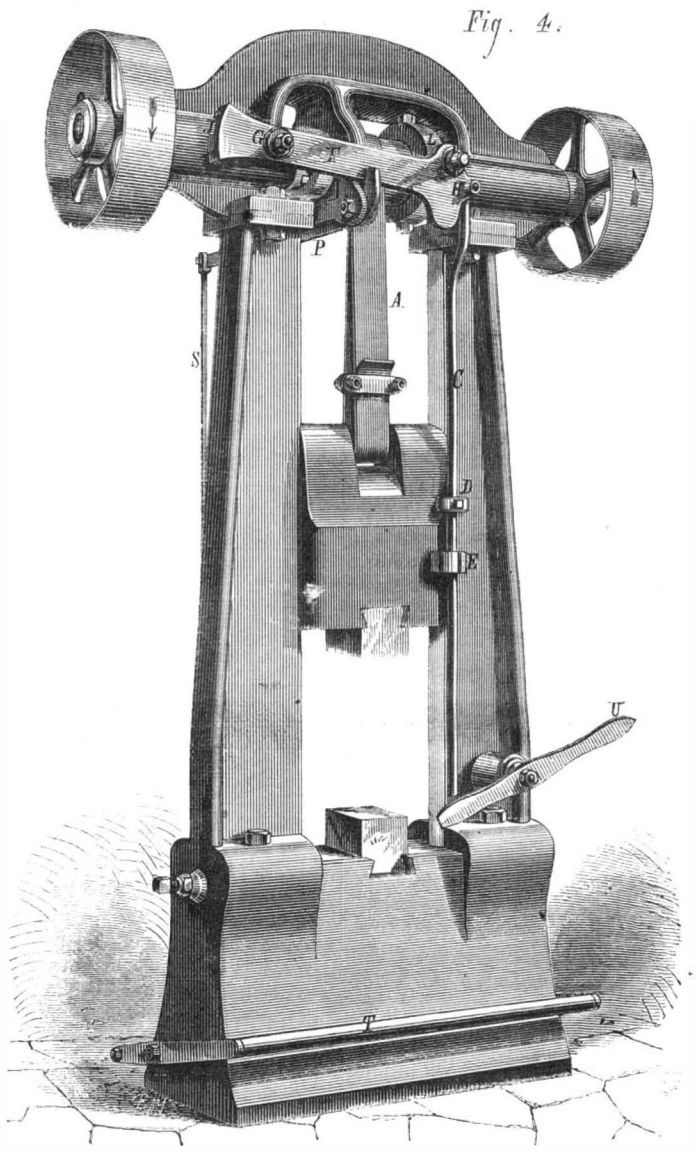


Fig. 4.



THE STILES AND PARKER PRESS COMPANY'S PUNCHING PRESS AND DROP PRESS.

The punching press, Fig. 1, has two novel features, the other parts being the same as is usual with this kind of press.

The first novelty is the pivoted bed, A, and the slotted arcs, B, by which the bed may be set either inclined, as shown, or horizontal for work in which the latter position is most convenient. Presses have hitherto been made with inclined beds or horizontal beds. The present improvement embodies the peculiar advantages of both styles. The arcs, B, are firmly held by the bolts, C, so that the bed may set inclined for work in which the punched pieces are desired to slide out by their own gravity, or adjusted to the horizontal position.

The second novelty is shown in detail in Figs. 2 and 3, which respectively represent a plan and a side elevation of the stripper. The principle of the gimball, or universal joint, is applied to this, it being made in two parts, D and E. The part, D, is pivoted to the blocks, F, Figs. 1 and 2, and the part, E, is pivoted to D, at right angles with the first mentioned pivots, so that a universal motion is secured, which, no matter what may be the unevennesses of the punched piece, insures its being stripped straight off the punch without breaking, straining, or bending the latter so as to force it out of adjustment with the die. For many kinds of work this will prove a valuable addition, as in delicate punching a slight bending of the punch causes it to conflict with the die, destroying its edge or breaking it altogether.

Fig. 2

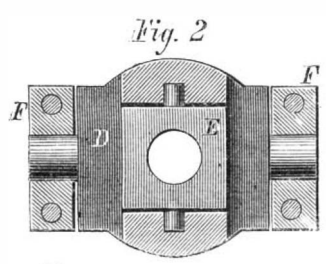


Fig. 3

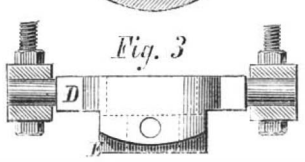


Fig. 5

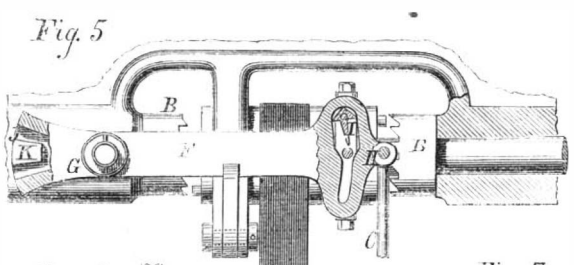


Fig. 6

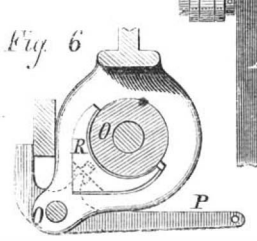


Fig. 7

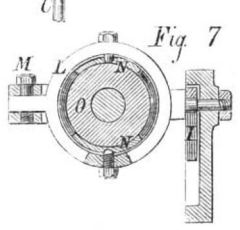
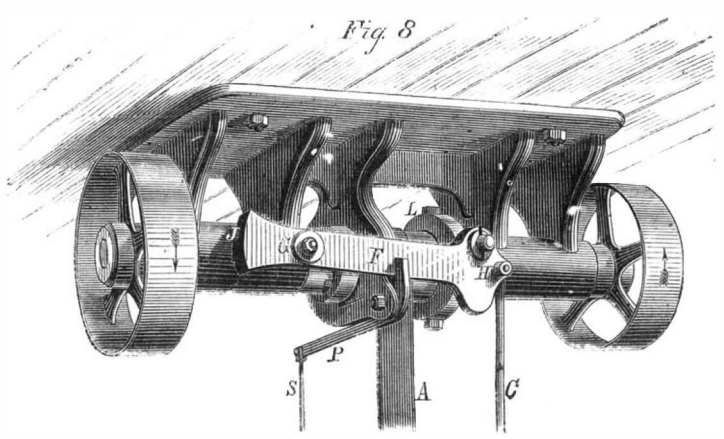


Fig. 8



The drop press is shown in perspective in Fig. 4. Details are represented in Figs. 5, 6, and 7, and a perspective view of the new features, applied to hangers so as to be readily adapted to any drop press now in use, is shown in Fig. 8. By the use of this latter, the advantage of the improvement will be secured at small expense to those having other drop presses.

The anvil, drop, bed, and guides are not essentially different from the presses already familiar to the mechanical public. The peculiarity consists in an arrangement of devices whereby the drop may be arrested in its ascent at any point while the machine is at work, and held there at the will of the operator, or dropped as may be desired, thus enabling the attendant to regulate the force of the blow to any extent. By this means, also, in adjusting dies for any kind of work, the drop may be lowered as gradually as desired, thus obviating the necessity of a tackle for that purpose, now generally required on other drop presses. A collateral advantage of economy of power is also secured, which, with other advantages, will appear as we proceed to examine the construction of the machine.

The drop is elevated by a strap, A, Figs. 4, 5, and 8, which strap is wound up on a spool, O, Figs. 6 and 7, which plays loosely on the main shaft, except when engaged with one or the other of the clutches, B, Fig. 5. These clutches are made to engage the spool alternately by an extremely ingenious combination of devices which is, so to speak, the soul of the invention, and the parts of which, shown in Figs. 4, 5, 6, 7, and 8, are the tripping rod, C, with the adjustable collar, D, the sliding collar, E, attached to the drop, the latch

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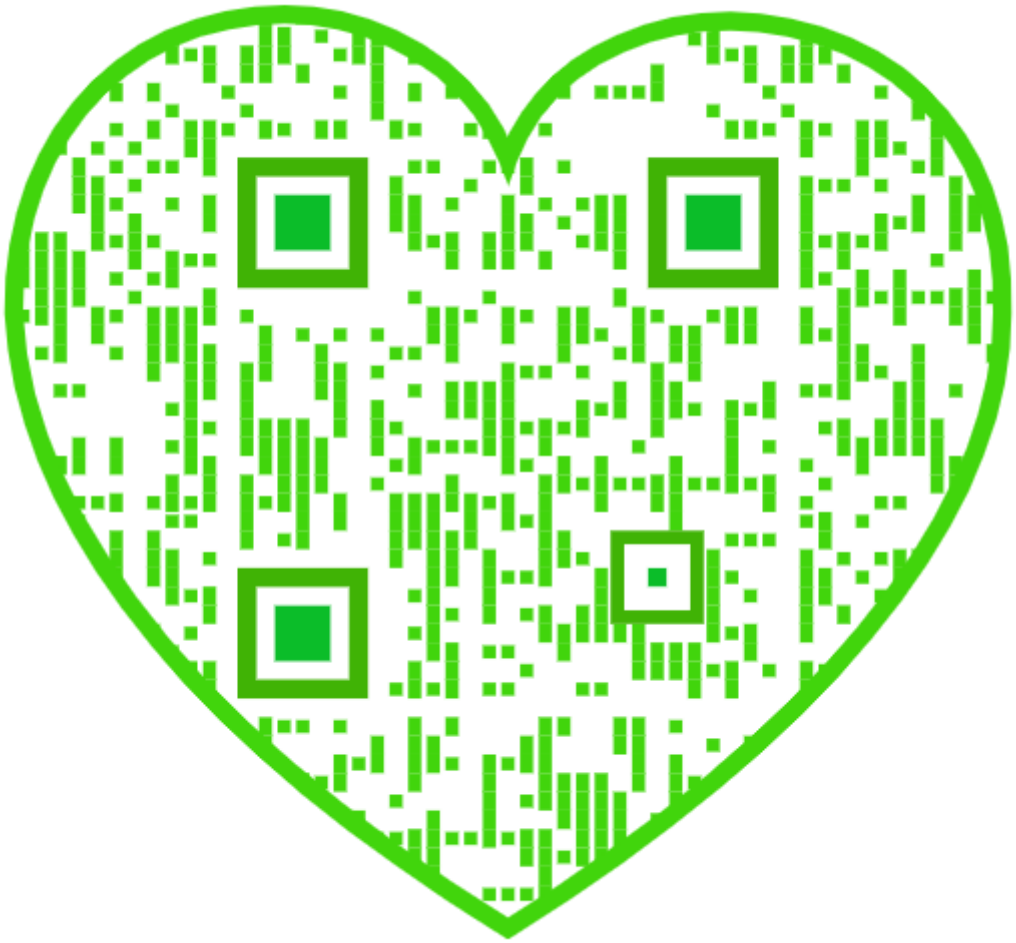

bar, F, pivoted to the frame at G, and to the tripping rod at H, the switch, I, Figs. 5 and 7, which is attached to the latch bar, F, and is moved with the latter in a manner described below, the crotch, J, in the latch bar, Figs. 4 and 5, acting in conjunction with the lug, K, on the frame, the collar, L, Fig. 7, pivoted at M, and actuating the pivoted shoes, N, which play in a groove of the spool, O, and which is actuated by the switch, I, so as to alternately move the spool into engagement with the clutches, B, Fig. 5, the brake lever, P, pivoted at Q, Fig. 6, and actuating the brake shoe, R, shown in Fig. 6—this shoe acting against the spool, O, when it is desired to arrest the drop and to hold it or to lower it slowly—the connecting rod, S, which connects the brake lever with the treadle, T, and the hand lever, U.

The action of these various parts is as follows: The hight to which the hammer will be raised is regulated by the adjustable collar, D, on the tripping rod, C, which may be set anywhere on the rod, to limit the distance through which the hammer will fall and the consequent force of the blow. For as the hammer rises, the sliding collar, E, engages the adjustable collar, D, lifting the tripping rod and the end of the latch bar, F, pivoted to the tripping rod, which, through the action of the switch, I, releases the spool, O, from its engagement with the spool clutches, B. At the same time, the latch bar, F, which, in the position shown in Fig. 1, engages the turned up end of the brake lever, P, preventing the latter from acting, releases this lever, and allows it to press the brake shoe against the spool with ample force to hold it from falling, the shoe being connected to the brake lever by a toggle joint arrangement shown in dotted outline in Fig. 6. This arrangement is adjustable to take up wear and always to keep the brake in order to act properly.

If now the operator presses with his foot on the treadle, T, he will raise the connecting rod, S, which actuates the brake lever, P, takes off the brake, and allows the hammer to fall. When the hammer falls, the latch bar falls, again engaging the brake lever, and also, through the switch, I, causing the spool, O, to engage one of the clutches, B, to raise the hammer again. The clutches, engaging alternately, wind the strap up always in the direction the spool, O, is turning, so that, as the hammer rebounds, there is no shock or sudden jerk on the strap, and the spool, gradually losing its motion, is slowly overtaken by the clutch which follows it, and the engagement is made without shock or jar. The crotch, J, of the latch bar acting in conjunction with the lug, K, on the frame, sustains the weight of the latch bar and tripping rod, so that these parts exert no brake-like action upon the spool to prevent its free movement and check the fall of the hammer, as would otherwise be the case. Everything runs as lightly as possible, and the consequence is a saving of power claimed to be at least one third of that required to drive the friction roller drop machines.

It will be seen that if the adjustable collar on the tripping rod be set at any hight, and the treadle, T, is kept depressed, a rapid series of blows will be delivered, the force of the blows corresponding to the adjustment of the collar. Again, if the treadle, T, be kept depressed, and the adjustable collar be set up out of the way, the tripping may be done by the hand lever, U, thus placing the force of the blows entirely under control of the operator, enabling him to give light or heavy blows and to vary their force according to the nature of the work in hand. These are very important features, which render the machine peculiarly adapted to many kinds of work. For instance, in forging a piece of iron, say one foot long, six inches wide, and one inch thick, the hammer will make its blow on the end, edge, or side of the piece, and go up to its original hight without any care or action on the part of the operator. Again, in welding, the hammer will deliver light blows at first, and follow with heavy ones, as required, through the use of the hand lever, which may be, if desired, attached by a rod to a suitable foot treadle, so as to leave both hands of the attendant free. We might enumerate many other kinds of work in which these features will be found advantageous, but what we have said will suffice.

The hammer can be run very rapidly: one hundred blows, from one foot hight per minute, can be obtained with ease.

Patents are pending through the office of the Scientific American Patent Agency, upon these improvements, which are the inventions of Mr. N. C. Stiles, of the Stiles and Parker Press Company, of Middletown, Conn., which company may be addressed for further information.

The Grain Elevators at Liverpool.

The only grain elevators in the United Kingdom are those of the Mersey Dock Board, situated on the Liverpool and Birkenhead sides of the river; and of these we have recently received some particulars. The scene of operations is a huge pile of warehouses, or granaries, covering several acres of ground, and reaching upwards to the hight of some six or eight floors. The grain ships arrive alongside these warehouses, and the cargo, whether in bulk or in bag, is emptied into what is called the "well" of the building, a depth of 22 feet below the level of the quay. It falls into a "hopper" capable of holding six tuns; and it need scarcely be stated that the object of thus lowering it is to dispense with the manual labor which would otherwise be necessary in filling the apparatus by which it is raised to the different floors. Corresponding with the "well" at the bottom of the building is a "tower" at the top, and the distance between the two is 145 feet. A bucket worked by a hydraulic ram travels between the two, and when a given quantity of grain has been emptied into the hopper the bucket descends, and by liberating a certain spring on its way to the bottom of the well, an arrangement is brought into play whereby the filling of the hopper is suspended, and the grain contained in the lower or sloping part, empties itself into the bucket. The hopper is made to hold six tuns, and the quantity discharged at each descent of the bucket is one tun, that being the quantity contained in the part of the hopper below which the filling process has been temporarily suspended by the action already described. A single stroke of the ram, and the bucket is raised from the bottom of the well to the top of the tower; the distance of 145 feet with a tun of grain being accomplished in forty-five seconds. On its upward journey, the bucket, which, it should have been stated, works on a sort of rails or guides, replaces the arrangement disturbed by its downward motion, and the process of filling the hopper is once more restored. Reaching the top, the bucket is acted upon by what is called the "tipping wheel," and thus made to empty itself into the tower, where the contents are weighed and got in readiness for distribution throughout the different floors and sections of the immense building. This subsequent process is even more novel and interesting than that just described. The upper floor of the warehouse is traversed in every direction by belts or bands revolving on pulleys, driven by small hydraulic engines. These bands, which are composed of india rubber and canvas amalgamated, are from fifteen inches to eighteen inches in width, and about one fourth of an inch in thickness. A sort of "mouthpiece" is fitted on to the bottom of the hopper containing the particular kind of grain to be distributed; and by this means it is thrown on the band revolving underneath, in an even and continuous stream, and in sufficient quantity to keep the bucket going regularly between the well and tower, with its load of a tun every three quarters of a minute.

The grain is carried forward on the band at a very considerable speed; and by the introduction of what is called the discharging or throwing-off apparatus, which can be attached at pleasure, it can be deposited in any section of the top floor, or diverted down shoots which carry it to any of the numerfloors underneath.

These warehouses in Liverpool have been in operation about three years. The machinery, which is of a very simple but effective character, was supplied by the firm of Sir W. Armstrong, of the Elswick Works, Newcastle-on-Tyne; and the system is stated to be superior to that in operation at Chicago, where "grain elevators" are quite an institution. The capacity of the Liverpool warehouse is something like 40,000 tuns.—*Builder.*

Hawley's Metal Roofing.

Mr. William S. Hawley, of New York city, assignor to David J. Millard & Co., of Clayville, N. Y., has invented an improvement in composition metal for roofing and other purposes, for which he has just obtained a patent through the Scientific American Patent Agency. This invention relates to metal which is adapted to roofing, linings, pipe, either cast or made from the sheet, and other purposes, forming a composition metal, which, when rolled into sheets suitable for roofing, linings, and all similar purposes, or cast or made into pipe, and is designed to resist the action of salt water and most of the acids, and does not perceptibly expand or contract from heat and cold.

Lead, tin, bismuth, and aluminum, or lead, tin, and bismuth without the aluminum, and with or without the bismuth, according to the use for which the metal is intended, are employed. In forming the composition metal, the above mentioned metals are used in various proportions, but never so much as one fifth part of tin to four parts of lead is used.

The inventor claims to have discovered that, by using a much less quantity of tin to a given quantity of lead, an article subject to no mechanical difficulties in the process of manufacture, and in every way superior to what has before been manufactured, can be produced. He has found that a metal composed of lead, one hundred pounds, tin, sixteen pounds, and bismuth, one ounce, with from three to five pounds of aluminum added, is best adapted for roofing and the other purposes for which it was intended. As the purposes are various, the proportions named may accordingly be varied, and the aluminum or the bismuth may be dispensed with where it is not desired to furnish a very fine quality of metal.

The metals used may vary from five pounds to twenty pounds of tin to one hundred pounds of lead, and from one ounce to two pounds of bismuth to the said quantity of tin and lead, when bismuth is used.

In preparing the metal, the lead is fused in an iron vessel, and then the block tin is added, taking care that the lead is not at so high a temperature as to burn or vaporize the tin. When the tin has been fused and thoroughly mingled with the lead, about half a pound of tallow to the hundred pounds of metal is introduced, which cleanses the combined metals from all the impurities, which may be skimmed from the surface. The bismuth is then introduced, and also the aluminum when aluminum is used. When the composition has been thoroughly stirred, it is ready to be poured into the molds, and thus formed into ingots or slabs. After being perfectly cooled, the ingots or slabs are ready for the rolling mill.

This composition metal can, it is claimed, be cast and rolled without cracking, and no mechanical or other difficulties are met with in rolling it to extreme thinness, making a most tough and tenacious sheet, admirably adapted for roofing, lining barrels for holding petroleum, mineral water, and all similar fluids, sheathing vessels, watertight floors, damp walls, and various other purposes. It is also averred that no acids affect it which will not destroy gold and silver.

The advantages and value to the public of such a metal will be apparent to all having a general knowledge of the many uses to which it can be put.

Shad Breeding.

In April, 1868, the Legislature of the State of New York passed a much needed act for the protection of fish. The Hudson river was at the moment practically closed by various nets of so small a mesh that mature shad could not ascend to the usual spawning beds.

This act specifies four and a half inches as the smallest mesh to be used in a shad net, and provides, under penalty, for the opening of all nets or traps from sundown on Saturday until sunrise of the following Monday. It also designates the season for shad fishery to be those days between the 15th of April and the 15th of June. Horatio Seymour, George G. Cooper, and R. B. Roosevelt were appointed Commissioners of Fisheries.

These gentlemen at once engaged the services of Mr. Seth Green, and set him at work to restock the Hudson river with shad, and save to the people a food source which bade fair to be presently exhausted.

Mr. Green selected for his work a location on the right bank of the Hudson, some four miles above the town of Coeymans. At this point, a low island affords protection from wind and the wash of passing steamboats. It is convenient to some of the best fishing grounds of the river. The fish are taken by seine at night. The ova is gently pressed from the female (if ready for spawning), into a pan of water kept in gentle motion. Care is taken not to injure the shad before spawning it. The male shad is made to evolve sufficient milt to impregnate the eggs, which seem instantly to lose their opacity, and become crystals of more than double their impregnated size. From the pans they go to the hatching boxes contrived by Mr. Green—a simple wooden box of fifteen by twenty two inches, fitted with a wire bottom, and arranged with strips of wood fastened on each side to float with the wire bottom at such an angle to the tidal current as will keep the eggs in continual motion, with the exception of a short time at the changing of the tides, when it is necessary to occasionally shake the boxes to keep the spawn from settling to the bottom, a thing fatal to the life of the ova.

From three to five days are necessary to hatch the spawn. The fry, at once capable of taking care of itself, is set free at night, when small fish with appetite for shad fry are close in-shore, and not swarming after the boat, as is the case during the daytime, when they accompany it on each visit to the hatching boxes to secure the dead spawn, which must be frequently removed from the boxes. A full grown female shad will spawn upward of one hundred thousand eggs, of which number it is said that no more than a few hundred will be hatched in the natural way, while by good handling upward of ninety thousand may be secured by artificial hatching. Mr. Green has already turned some hundreds of millions of shad fry loose at different points in the Hudson, and expresses a belief that three hundred millions of young shad may be hatched out and set free during the few weeks of time devoted to the work. The expense is comparatively small; a few hundred dollars cover the entire outlay. Certainly this is a judicious expenditure of the people's money, securing, as it does, a vast food source which would otherwise have dwindled to a supply inadequate to furnish more than a small quantity, which would have found its way only to the tables of the wealthy.

Other States are devoting attention to the subject of pisciculture as a food source, stocking streams and lakes which have for years been tenanted only by small and comparatively valueless fish. In this work Mr. Green gladly assists, his great knowledge of the subject rendering his advice invaluable.

This season's shad hatching will be commenced by Mr. Green as early as May 20, and the work will reach its most interesting point about the 20th of June.

Sub-Aqueous Tunnel.

A railway tunnel is now being constructed under the river Mersey at Liverpool, England, to connect that city with the opposite city of Birkenhead. It will be about three miles in length, about one third of which will be under the bed of the river, and it will connect nearly all the railways in England with the Birkenhead docks. The effect of this great undertaking, as well as of the fine river approaches—a sister scheme, and working in the same direction—cannot but be in the highest degree beneficial to local trade. The improvement has already commenced. The preliminary operations for the formation of the tunnel have been completed. A hoarding has been erected on the south reserve land, between Shore road and the river, close to Woodside Ferry, and workmen have commenced preliminary operations for sinking a shaft, in order to attain the depth of 70ft. below the bed of the river, at which point the cutting of the tunnel railway will be undertaken. The contractor for the work is Mr. John Dickson, of Whitby, and the engineer Mr. Mackenzie. The tunneling will be performed with two machines, each of which will make a cutting 15ft. in diameter. Two other shafts are to be sunk on the Birkenhead side, one on the upper side of Shore road, and the other between the gasworks and Green lane, Tranmere, where will be situated what may be called the Cheshire terminus, the line there joining the Birkenhead and Chester Railway. It is anticipated that unless serious geological "faults" are met with, the cutting of the tunnel, which is to accommodate a double line of rails, will be completed in two years. We are in hopes that, by that time, our capitalists will be moved to commence the construction of tunnels under the North and East rivers at New York.

One of the salts most sensitive to heat is the double iodide of silver and mercury. Its natural color is yellow, but it turns red if warmed, and returns to yellow again on cooling.

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THE TALLOW TREE AND ITS USES.

BY D. J. MACGOWAN, M.D.

The botanical characters of this member of the *Euphorbiaceæ* are too well known to require description; but hitherto no accurate account has been published of its various uses. Although it has become a common tree in some parts of India and America, its value is appreciated only in China, where alone its products are properly elaborated.

Analytical chemistry shows animal tallow to consist of two proximate principles—stearine and elaine. Now, what renders the fruit of this tree peculiarly interesting is the fact that both these principles exist in it separately in nearly a pure state. Nor is the tree prized merely for the stearine and elaine it yields, though these products constitute its chief value; its leaves are employed as a black dye; its wood is hard and durable, and may be easily used for the blocks in printing Chinese books and various other articles; and, finally, the refuse of the nut serves for fuel and manure.

The *Stillingia Sabifera* or tallow tree is chiefly cultivated in the provinces of Kiang-se, Kiang-nau, and Chih-kiang. In some districts near Hang-chau the inhabitants defray all their taxes with its produce. It grows alike on low alluvial plains and on granite hills, on rich molds on the margin of canals, and on the sandy sea beach. The sandy estuary of Hang-chau yields little else. Some of the trees at this place are known to be several hundred years old, and, though prostrated, still send forth branches and bear fruit. Some are made to fall over rivulets, forming serviceable bridges. They are seldom planted where anything else can be conveniently cultivated, but generally in detached places, corners about houses, roads, canals, fields, etc.

In winter, when the nuts are ripe, they are cut off with the twigs by a sharp bill hook attached to the extremity of a long pole, which is held in the hand and pushed upwards against the twigs, removing at the same time such as are fruitless.

The harvesting accomplished, the capsules are taken and gently pounded in a mortar to loosen the seeds from their shells, from which they are separated by sifting. To facilitate the separation of the white sebaceous matter enveloping the seeds, they are steamed in tubs having convex, open wicker bottoms, and placed over caldrons of boiling water. When thoroughly heated they are mashed in the mortar and then transferred to bamboo sieves, kept at a uniform temperature over hot ashes.

As a single operation does not suffice to deprive them of all their tallow, the steaming and sifting is therefore repeated. The article thus procured becomes a solid mass on falling through the sieve, and, to purify it, is melted and then formed into cakes for the press. These receive their form from bamboo hoops, a foot in diameter and three inches deep, which are laid on the ground over a little straw. On being filled with the hot liquid, the ends of the straw underneath are drawn up and spread over the top, and, when of sufficient consistence, are placed with their rings in the press. This apparatus, which is of the rudest description, is constructed of two large beams placed horizontally so as to form a trough capable of containing about fifty of the rings, with their sebaceous cakes. At one end it is closed and at the other adapted for receiving wedges, which are successively driven into it by ponderous sledge hammers wielded by athletic men.

The tallow oozes in a melted state into a receptacle where it cools. It is again melted and poured into tubs smeared with mud to prevent adhering. It is now marketable in masses of about eighty pounds each, hard, brittle, white, and opaque, tasteless, and without the odor of animal tallow. Under high pressure it scarcely stains bibulous paper; it melts at 104° Fah. It may be regarded as nearly pure stearine; the slight difference is doubtless owing to the admixture of oil expressed from the seed in the process just described. The seeds yield about eight per cent of tallow, which sells for about five cents per pound.

The process for pressing the oil, which is carried on at the same time, remains to be noticed. It is contained in the kernel of the nut; the sebaceous matter which lies between the shell and the husk having been removed in the manner described, the kernel and the husk covering it are ground between two stones, which are heated to prevent clogging from the sebaceous matter still adhering. The mass is then placed in a winnowing machine precisely like those in use in Western countries. The chaff being separated, the white oleaginous kernels are exposed, and, after being steamed, are placed in a mill to be mashed.

This machine is formed of a circular stone groove twelve feet in diameter, tapering at the edge, and is made to revolve perpendicularly by an ox harnessed to the outer end of its axle, the receiver turning in a pivot in the center of the machine. Under this ponderous weight, the seeds are reduced to a mealy state, steamed in tubs, formed into cakes and pressed by wedges in the manner before described, the process of mashing, steaming, and pressing being likewise repeated with the kernels.

The kernels yield about thirty per cent of oil. It is called *tsing-yu*, and sells for about three cents per pound. It answers well for lamps, though inferior for this purpose to some other vegetable oils in use. It is also employed for various purposes in the arts, and has a place in the Chinese pharmacopœia because of its quality of changing gray hair to black, and other imaginary virtues. The husk which envelopes the kernels and the shell which encloses them, and their sebacious covering, are used to feed the furnaces; scarcely any other fuel is necessary for this purpose. The residuary tallow cakes are also employed for fuel; a small quantity of it remains ignited a whole day. It is in great demand for chafing dishes during the cold season.

Finally, the cakes which remain after the oil has been pressed out are much valued as a manure, particularly for tobacco fields, the soil of which is rapidly impoverished by that plant.

Burnt Iron and Burnt Steel.

Iron which has been damaged by reheating is designated "burnt iron" by the workman, who also gives the same name to iron which has been excessively heated and exposed in the puddling furnace after balling. No amount of heat applied to iron in the blast furnace or in the early stages of puddling produces burnt iron.

Burnt iron is brittle, its fracture is short, it displays the so called "crystalline" structure, and it has lost the fibrous structure and silky fracture of good iron.

When steel has been raised to a yellow or white heat and then suddenly cooled, it becomes brittle and no longer capable of tempering, is worthless for the ordinary uses of steel until again raised to a welding heat, and rolled or hammered and allowed to cool gradually. Burnt steel has a coarse granular fracture, the facets of the granules being, for the most part, either rounded or conchoidal. The conchoidal facets serve practically as a distinguishing characteristic.

I have examined many samples of burnt iron and find in all of them some particles of black oxide, more or less abundantly diffused throughout the mass of iron, suspended or entangled within it. I find no such particles of oxide in burnt steel, nor any other indication of internal oxidation of iron.

Important practical decisions often depend upon the determination of whether certain defects of particular samples of iron are due to burning or to other causes. I have devised a very simple means of answering this question. I take about a decigram of fresh borings or coarse fillings, put them into a dry narrow test tube, then pour upon them about three centimeters of nitric acid diluted to sp. gr. 1·20. If the iron is burnt, the particles of dark oxide become separated from the metallic iron as it dissolves, and are suspended in the liquid, rendering it dark and turbid. They ultimately disappear and are thus distinguishable from particles of carbon, etc. This action is easily recognized by treating equal quantities of borings of burnt and good iron simultaneously in the same manner, and comparing.

I find that ordinary sound wrought iron contains a small quantity of carbon, the most important function of which appears to be to prevent burning by its reducing agency. As soon as the carbon is removed, oxidation commences when the iron is heated, and this oxidation is not merely superficial but extends throughout the mass. The higher the temperature and the greater the amount of exposure to the atmosphere while heated, the greater is the quantity of carbon required for protecting the iron. This is, I believe, the reason why all attempts to make merchantable iron by the Bessemer process are a failure. The high temperature and the violent exposure of melted metal to the air forced through it causes oxidation of the iron to commence even in the presence of much carbon. This oxidation or burning of the iron commences in the Bessemer converter, when the proportion of carbon is brought down to about 0·25 per cent. 0·20 per cent, may be stated as the practical minimum to which it is possible to bring down the carbon of Bessemer metal without destroying malleability, but this is rarely reached. About 0·28 is the lowest ordinarily aimed at by the manufacturer.

I find that iron attains its maximum toughness, when it is otherwise pure, and its carbon is reduced to the lowest possible proportion without oxidation of the iron commencing.

Thus the success of the maker of armor plates, ship bolts, etc., depends upon his skill in exactly touching, without passing, the point at which the oxidation of carbon ceases, and that of the iron is about to begin. By skillfully conducting his last reheating processes by means of a reducing flame, he is able to work down to the lowest possible trace of combined protecting carbon, and thus obtain the maximum of toughness and extensibility.

I find, as a result of a large number of varied experiments, that whenever steel is raised to any temperature above the lowest visible red heat, and more or less exposed to the action of atmospheric air, its carbon is oxidized with a rapidity proportionate to the temperature and degree of exposure. These experiments have extended through a series of various conditions, from low heat and closed annealing furnaces to the great heat and excessive exposure of the Bessemer converter. This oxidation occurs not only at the surface, but proceeds inwards. It is now well known that certain gases can pass readily through heated iron, and thus the permeation of the oxygen and exclusion of the carbonic oxide no longer presents a difficulty. I, therefore, explain the structure and properties of "burnt steel" as the result of suddenly solidifying it, from the viscous condition which it attains at a welding heat, and thereby imprisoning the carbonic oxide evolved by the oxidation of the carbon. By slower cooling, the carbonic oxide would have become either occluded or expelled. This explanation accords with the fact that burnt steel may be cured, as above stated, by welding up the cavities or "toads' eyes," as the workmen call them, which are visible on the fracture of such steel. These, according to my explanation, are the minute bubbles formed by the carbonic oxide suddenly arrested in various stages of evolution or collapse.

According to the above, the workmen's term "burnt" is not incorrectly applied in either case, the rottenness of both the iron and the steel being caused by the presence of intermingled particles of combustion-products breaking the continuity of the metal. The carbon is burnt in the case of the "burnt steel," the iron itself in the "burnt iron."—*Journal of the Chemical Society.*

Light, Heat, and Electricity from Motion.

The celebrated Jacob Perkins when in London, in 1837, exhibited at the Adelaide Gallery the phenomena produced by the contact of soft iron with steel in motion, and which he described at the time as follows;

"The action of a soft iron disk upon hard steel, such as a file, is exhibited four times a day. This has been regularly kept up for three years, yet it has undergone very little wear. I am of opinion, in fact, that if the file had never been held upon it until it had attained its full velocity, there would not have been any loss of metal. I do not know to what extent the combustion of steel by soft iron may have been carried in the United States, but our experiments are so brilliant as to excite the highest admiration, and to induce numbers to repeat their visits to the Gallery. Our disk is a foot in diameter and an eighth of an inch thick. It requires about a three horse power to drive it, and revolves about 6,000 times in a minute. It is very accurately fitted up with friction wheels. The blaze of light, which rises about 12 inches, perpendicularly, from the point of contact, is so vivid that few persons can look steadily at it even at noon day. The stream of light is about an inch and a half thick at the distance of a few inches from the point of contact; and at the distance of 7 or 8 feet, it spreads out to about 10 inches. The sparks not unfrequently touch the ceiling, which is about 20 feet high; a ring of fire is seen all around the disk, appearing like a band of light about five eighths of an inch wide. Of what does this light consist? It is manifestly different from that of the sparks, which all fly off in a tangent. In operating with the disk, it never becomes warm; the file, however, has to be held at least two inches from the sharp end, as it becomes highly heated. The whole appearance, in fact, is very interesting, and when fully investigated, I am well convinced that some of the phenomena will be found to depend upon electricity."

Brandy from Wood Shavings.

C. G. Zetterlund has been making some experiments in the distillery at Hulta to make brandy out of shavings. For this purpose, they were boiled in an ordinary kettle under a pressure of 0·116 kilograms of steam to the square centimeter. There was then put into the kettle: Shavings (pine and fir, very wet), 9·0 cwt.; sulphuric acid, 1·18 sp. gr., 0·7 cwt.; water, 30·7 cwt.—Total, 40·4 cwt.

After boiling eight and a half hours, the mass of shavings contained 3·33 per cent grape sugar, and after eleven hours cooking, 4·38 per cent. A farther increase in the quantity of sugar could not be attained. There was obtained in all, from the 40·4 cwt., about 1·77 cwt. of grape sugar, or 19·67 per cent of the weight of the shavings. The acid was neutralized by lime, so that the cooled mash ready for fermentation contained one half degree of acid, according to Ludersdorff's acid tester. The mash had a temperature of 30°C. when the yeast prepared from only 20 pounds of malt was added. At the end of 96 hours, the mash had done fermenting, was then distilled and yielded 61 quarts of 50 per cent brandy at +15°C., perfectly free from all flavor or smell of turpentine, and of a very pure taste.

It is more than probable that the manufacture of brandy from shavings on a large scale would succeed if it were ascertained, by experiment, with how much water the acid must be diluted, and how long it must be boiled, for both of these circumstances exert a great influence over the production of sugar.

If it were possible to convert the whole of the cellulose in the shavings into sugar, each hundred weight of air dried shavings would yield about seven gallons of brandy of fifty per cent. The shavings of the leaf bearing trees would probably give the best results.—*Journal of Applied Chemistry.*

EFFECTS OF FROST ON PLANTS.—It has been a disputed question whether plants, killed by frost, die in freezing or in thawing. That the former is the case, at least in some cases, has been satisfactorily demonstrated by Professor Göppert, of Breslau. The flowers of certain orchids, as, for example, the milk white blossoms of *Calanthe veratrifolia*, produce indigo, but only by a chemical reaction that takes place upon the death of the parts. When they are crushed, or the vitality of the cells is otherwise destroyed, they turn blue at once. Now this change of color occurs immediately upon freezing, which proves that life then ceases. Certain other species are said to show the same thing.

A FRENCHMAN named Wilbaux has taken out a patent to use an elastic type for printing on glass, with fluor spar rendered adhesive by some such material as printing ink. Sulphuric acid of suitable temperature is then allowed to act on that portion of the glass. The hydrofluoric acid generated in this way would etch the glass on the places printed on. When completed, the whole is washed off with warm water or lye.

TO KEEP GUM ARABIC FROM MOLDING,—Solutions of gum arabic soon mold and sour, and finally lose their adhesive property. It is said that sulphate of quinine will prevent this, while it imparts no bad odor of its own. The addition of a solution of a few crystals of this salt to gum arabic will prevent the formation of mold quite as effectually as carbolic acid, and by analogy it is safe to suppose that the same salt could be used in writing ink, mucilage, and possibly glue.

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FIRST GRAND INDUSTRIAL EXPOSITION OF LOUISIANA.

The above exhibition will open on May 1st, in the new and convenient building situated at the junction of Carondelet and St. Charles streets, New Orleans, La., and will continue till May 22d. This preliminary exposition is intended as the opening of a permanent exposition. In the preliminary exposition, no charge will be made for space. When the building is opened on June 3d as a permanent exposition and salesroom, for manufacturers, artists, inventors, etc., a charge will be made to those who occupy space and avail themselves of the opportunities thus afforded. No premiums or diplomas are to be offered; the public will be the sole judge of the merits of the articles exhibited. By late advices, we are informed there is a good prospect of an interesting display.

We give on this page a view of the exposition building, which occupies an entire square.

The exhibition is held under the management of the Southwestern Exposition Association of New Orleans, La.

Northern manufacturers will probably find this a good introduction for their wares into the Southern market, more especially for agricultural and other labor-saving machinery.

EXPOSITION BUILDING, NEW ORLEANS.

Automatic Cattle Stanchion.

Fastening cattle in stables is accomplished by many different methods, the majority of which are inconvenient for the keeper and exceedingly uncomfortable for the animal. It has long been a conceded fact, among dairymen, that fastening cattle in stanchions is the only economical method where any considerable numbers are kept in one herd. A chain around the animal's neck, with a ring sliding upon an upright standard, has been used to a considerable extent. This, although easy for the animal, is a very inconvenient and oftentimes dangerous method of securing cattle. It requires more room and a much greater amount of lumber to fit up a stable.

For milch cows the use of chains and rope ties was long ago discarded, on account of the unavoidably filthy condition of the stable, the legitimate result of too much liberty. Box stalls have advocates, and for breeders of fancy cattle may have their advantages, but they occupy much room, are very expensive and, for the dairy, would be exceedingly inconvenient.

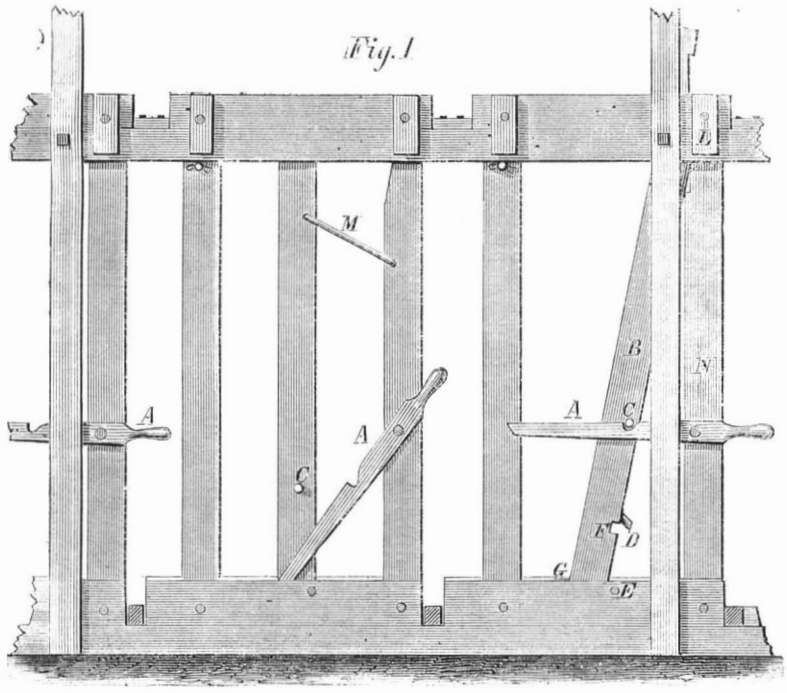
The custom of milking in the stable the entire year has become almost universal, and for the comfort of those engaged in milking, and also for the health and comfort of the cows, it is very essential that the circulation of air should not be obstructed by partitions (other than perhaps narrow hooking boards) either in the stable or manger. In most business transactions, we justly expect the best results from the employment of the best means. Why not in the management of farm stock? It is often the case that cows will back out of ordinary stanchions before they can be fastened, and seriously damage each other ere it can be prevented.

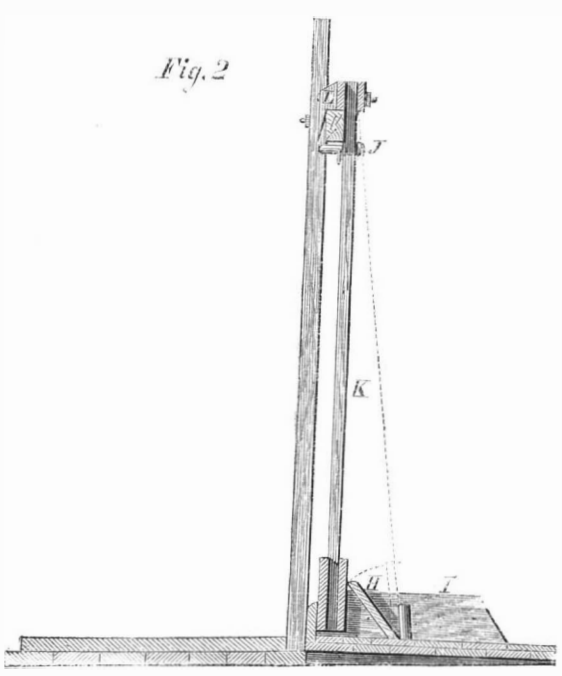
In the stanchion herewith presented to the public, it has been the object of the inventor to make such improvements as will do away with the many objections heretofore raised against fastening cattle in stanchions.

The superiority of a swinging over a stationary stanchion is at once apparent to the most casual observer. This stanchion the inventor styles the "Swinging, Self-Closing, Self-fastening Cattle Stanchion."

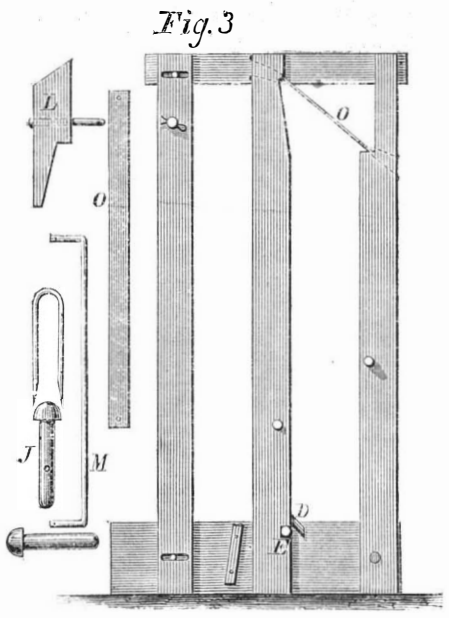
In the common stationary stanchion, it is very difficult for a majority of animals to rise without making several attempts, but in these the yielding of the stanchion allows the shoulders of the animal their natural forward movement, so that the animal can rise as easily as though it were not fastened. The stanchions are hung in such a manner as to allow a sliding or sidewise movement, if desired, by simply shortening the upper and lower transverse bars. The space for the animal's neck is adjustible to any desired width, the bars being slotted transversely where the bolts pass through them, allowing them to be moved either right or left. The stanchions are self-closing and self-fastening, thereby saving a vast amount of time, and any one of them can be instantly unhung without disturbing the remainder.

Fig. 1 is a view, from the stable side, of a section of a row of finished stanchions, one opened and one closed. It also shows the manner of hanging. Fig. 2 is a vertical section of Fig. showing the manner of hanging, also the means of preventing the animal from lifting the stanchion from its bearing, by the insertion of the loose pin, J. It also shows the construction of the feeding manger, devices for limiting the swing, stanchion, grain board, guide, etc. Fig. 3 shows the interior arrangement of the closing and latching devices, the device for adjusting the space for the animal's neck, and enlarged views of the arms, hook, button, etc.





GIFFORD'S AUTOMATIC CATTLE STANCHION.



To open the stanchion, the attendant presses down on the handle of the lever, A, until the upright bar, B, is raised and opened, the notch in the lever catches the pin, C, and holds it in the position as shown. The animal, in lowering its head for food, unlatches the lever from the pin, and the stanchion closes by its own weight. As the bar, B, descends, the inclined pin, D, strikes the pin, E, and latches the bar, B, in the notch, F. G is a guide to the bar, B, as it rises and falls. H, Fig. 2, is a loose grain board between the guides, I, rocking back and forth with the swing of the stanchion.

To unhang the stanchion, remove the pin, J, from the bar, K, and lift the stanchion from its place. L is a hook button made of hard wood, cut in the shape shown in Figs. 2 and 3, to allow the stanchion to swing forward. M, Fig. 3, is an arm made of half inch round iron, bent at right angles with the keyholes near the ends, the wrists of which pass through the bars, B and N, Fig. 1. O, Fig. 3, is another form of arm, made of one quarter by one inch bar iron, with holes near the ends for the reception of staples, by which it is hinged to the bars, B and N, as shown in Fig. 1. These arms operate to open and close the space for the animal's neck.

These stanchions are simple, cheap, and durable, requiring no iron hinges, and but four bolts in their construction.

This invention was patented through the Scientific American Patent Agency, May 10 and July 19, 1871, and May 30, 1872. For purchase of territory or other information, address Gifford and Robertson, Jamestown, N. Y.

Japanese Porcelain.

The Japanese artists have long distinguished themselves in the ornamentation of porcelain, and many of their styles are of great beauty and originality. Their blue and white wares are somewhat similar, in general appearance, to those made by the Chinese, but can be readily distinguished from them by any one conversant with the peculiarities of Japanese art.

The most beautiful and artistic of all the ficile wares of Japan is the Satsuma. This is made in the province of Satsuma, situated in the southwest of the island of Kinsin. The body of the ware is of delicate cream or vellum tint, and is covered with a thick transparent glaze, which is in nearly all cases crackled. On this softly toned ground, figures, birds, flowers and conventional designs are painted in the most exquisite manner imaginable. The freedom and grace infused into every line of the flower and bird subjects are astonishing, while the coloring is soft and refined.

Another beautiful ware, richly ornamented with red and gold, is made in Japan, in the district belonging to the Prince of Kanga. The ornamentation of this ware is infinitely more minute and labored than that of Satsuma, but is far inferior to it in artistic excellence. Kanga ware appears to be held in great estimation in Japan, no doubt on account of its fine color and intricate ornamentation. The Japanese frequently lacquer articles of porcelain, sometimes entirely and sometimes partially. When entirely covered, they are treated, as regards their decoration, in a similar manner to ordinary lacquer work; when only partially covered, two methods are adopted. The first method consists in grounding in with lac all portions of the object, excepting those which have been already decorated and intend to remain in their original state; and the second method consists in taking the porcelain itself as the ground, and ornamenting it with raised designs in gold and colored lacs.

AT a recent trial of bicycle velocipedes in London, one of the riders made two miles in less than seven minutes, being at the rate of over seventeen miles an hour. Another rider made four miles in 17m. 21s., being at the rate, almost, of 14 miles per hour. The diameter of the wheels of the bicycles used was 4 feet 4 inches.

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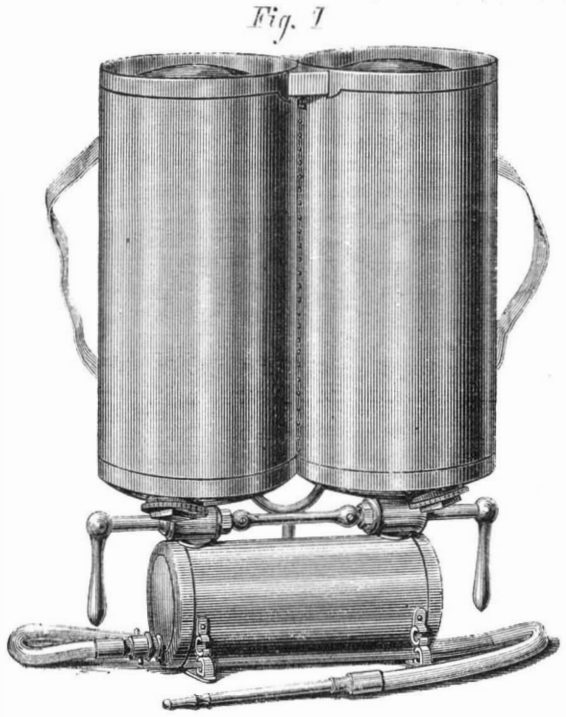
GARDNER'S FIRE EXTINGUISHER.

We need not repeat what we have so often said in regard to the value of small portable apparatus for extinguishing fires at their very outset. Suffice it to say that our views upon this subject have been generally approved by those who have made the extinguishing of fires a study. Among apparatus of this kind, none have so rapidly won their way into public favor as extinguishers the action of which is based upon the fact that no fire can live under even the thinnest stratum of carbonic acid gas. An envelope of this gas so effectually cuts of the supply of oxygen from the air that, when combined with water so as to cool the heated surface below the point of ignition, it forms the best known means for the extinguishing of a fire.

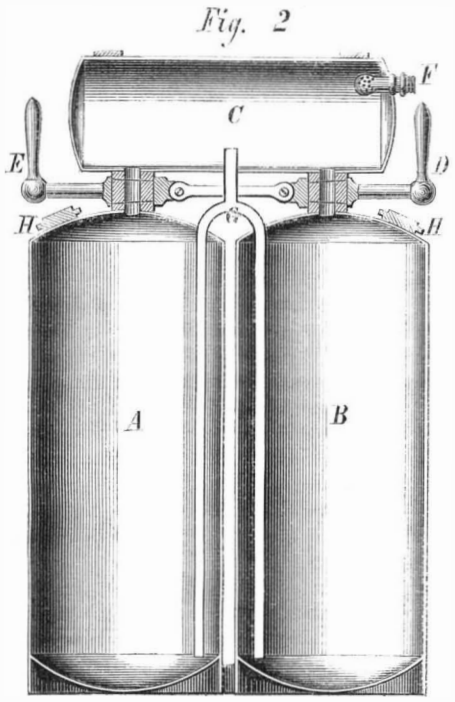
Fig. 1



Quite a number of devices have been brought out, all designed to render easy and rapid the use of carbonic acid gas and water for this purpose. The apparatus shown in our engravings has points claimed to give it superiority over others which have preceded it.

The parts of the device, as lettered in the engraving, Fig. 2, are an acid chamber, A, a bicarbonate of soda chamber, B, a gas chamber, C, handles of stop cocks, D and E, the two

Fig. 2



handles being joined by a rod so that either hand may be used for operating them, hose coupling, F, equalizing pipe, G, which keeps the pressure uniform throughout the machine, and stoppers, H, which are removed for charging the machine.

The acid chamber, A, is charged with dilute sulphuric acid (oil of vitriol), and the soda chamber with solution of bicarbonate of soda, equivalent proportions being used. When not in use, the machine is placed in the position shown in Fig. 2. In this position the acid and soda are kept asunder, and no gas is generated.

In use the position of the machine is reversed, as shown in Fig. 1, straps being provided whereby the machine is held upon the back of the operator. In the latter position, when the cocks are opened, the acid and soda solutions flow into the gas chamber, C, where the sulphuric acid instantly sets free the carbonic acid in the bicarbonate of soda, generating a high pressure, which causes a jet of mingled solution of sulphate of soda and free carbonic acid to issue from the hose pipe. This being properly directed, first upon the bottom of the fire, and so upward as the fire is extinguished, will soon put out quite a formidable conflagration.

The advantages of this extinguisher are that the diluted sulphuric acid and the solution of bicarbonate of soda are kept in separate chambers, and brought together when needed for use simply by turning the handle of a stop cock.

They are brought together in equivalent proportions, and the stream of a solution of sulphate of soda is thereby charged with carbonic acid gas from the start.

As much or as little of the charge may be used as is desired, and the remainder saved, for any future time, perfectly unaltered and unimpaired.

When the machine is charged and set away, the stopcocks and mechanical arrangements are never in contact with the chemicals. This is considered one of the greatest advantages of the machine, and is a point in which we believe it differs radically from all other extinguishers.

The machine is made of polished copper, lined with lead to prevent corrosion, and the stopcocks are made of lead bronze, and will resist all chemical action from the materials used. The machine is so constructed that it fits the back firmly and steadily, because, there being two upright chambers to contain the chemicals, the weight is equally distributed. It weighs only 65 pounds when charged, and it is claimed that it is lighter than any other machine of the kind, and can be put in action more promptly.

Patented February 14, 1871. For further information, address Philadelphia Fire Extinguisher Company, 1,306 Chestnut street, Philadelphia, Pa.

BUTTER FROM CALIFORNIA.

The transporting of fresh grass butter from the Pacific coast to New York, by rail, is something new, and is likely to become a large business.

A few days ago, a car load of 20,233 lbs. arrived from San Francisco, consigned to J. S. Martin, corner Chambers and Greenwich Streets, creating quite a sensation among the butter dealers. By the courtesy of R. L. Stuart, Esq., a well known resident of this city—but who, from the note accompanying it, we infer is at present a guest at the Fort William Henry Hotel, Lake George—we are indebted for a handsome cylindrical roll of the new butter, from the first shipment across the continent. Other shipments are announced; and if the experiment of bringing yellow grass butter, fresh from the Pacific coast, proves as feasible as it seems likely from the satisfactory result of the first shipment, we may expect to get our spring butter in this city much earlier as well as cheaper than heretofore. The color of the California product is all that can be desired, and the flavor quite equal to State butter of a month hence. It costs in San Francisco 30 cents, gold, and the freight is 2½ cents per pound, which leaves the seller in New York a fair profit at 40 cents per pound. It comes in neat 2 lb. cylindrical rolls, each wrapped in cloth, similar to the Philadelphia mode of putting up butter.

Printing from Iron.

Mr. Van Ruth, who has for several years acted as inspector of iron for the Dutch Government, has from time to time turned his attention to discovering some means of examining the fiber of iron, and recording it for the purpose of comparison. After several trials, he has arrived at an extremely simple and efficient method of obtaining the results required.

The sample of iron whose fiber is to be examined is first planed, so as to expose a suitable section, through any desired point; this section is immersed in muriatic (hydrochloric) acid for such time as is necessary to eat out the cinder; this time varies from six hours to twenty-four hours, according to the strength and temperature of the acid solution. The cinder is attacked in a more rapid manner than the fiber of the iron, and the effect is that the fiber is left in relief—in fact an etched plate is formed, from which, by suitable ink or other substance, an engraving may be printed, showing every fiber of the iron in a clear and distinct manner. The application of this simple process is too obvious to need much description. Whenever the formation of piles in a rail, round or other section of iron, is required, here is a quick and handy method for discovering it. As a means of studying the alteration of fiber in the neighborhood of welds, it is invaluable. It may also be applied in supplying information in relation to M. Tresca's valuable memoirs on the flow of solids.—*Engineer*.

The Thunderer.

A new armored war vessel, on the turret or monitor plan, called the "Thunderer" has lately been launched in England. The vessel has a burthen of 4,400 tuns, carries two turrets and four 35 tun guns, being the heaviest naval armament known. Her expected speed is 12½ knots per hour.

As she is to rely, like a true Monitor, upon steam alone, and is totally unprovided with masts or sails, she is provided with two distinct sets of engines, connected with twin screws, and capable of acting independently of each other. The object of this arrangement is that, if one of the engines is disabled, the ship will not be left without any means of motion beyond the caprice of the waves. Perhaps one of the most remarkable features of this wonderful vessel is its capacity for stowing away coal. It can carry more than twice the quantity of the largest of the iron clads, being able to provide itself with a sufficient consumption for 12 days, or as much as 1,750 tuns.

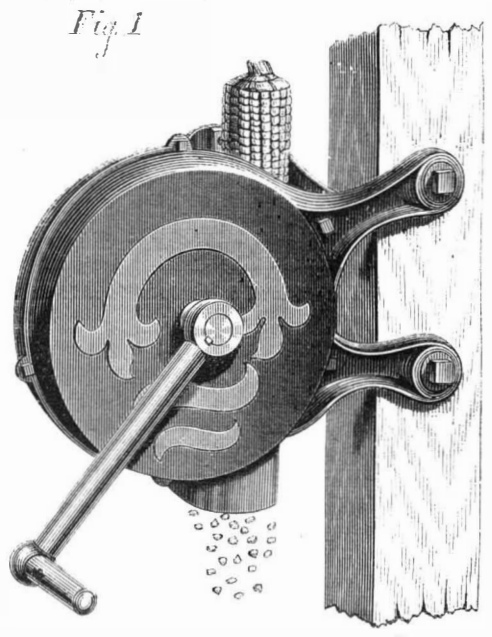
The *Thunderer* has a horse power of 5,600, divided between two double engines. The length of the vessel is 285ft. her breadth amidships 62ft., and she will draw about 26ft. of water when fully equipped. Although the iron at the stem of the ship will not exceed 8 in. in thickness, the broadside is protected by 12 in. of plating, while the turret carries 14 in. of armor, supported by the usual backing. The plating of the *Thunderer* is thus thicker than that of any other iron-clad, except her sister ship, the *Devastation*, and appears to be as strong as can be carried by vessels of the size. In order to assure the stability of the ship, no masts have been placed in her, and the sole motive power lies, therefore, in her engines. The *Thnnderer* is altogether the completest and strongest iron clad yet constructed.

PATCH'S CORN SHELLER.

The extreme simplicity, durability, and compactness of this machine, together with its efficiency and convenience, will commend it to all who understand the need and use of a good corn sheller. The working parts are so few and so easily made (nearly all of them can be cast) that the machine can be constructed very cheaply. There are no complications to perplex the inexperienced, and no nice adjustments are required. The machine can be bolted to an upright post, and is then ready for work.

Two pan shaped castings bolted together form the case. One of these is removed in Fig. 2. The other, lettered A,

Fig 1



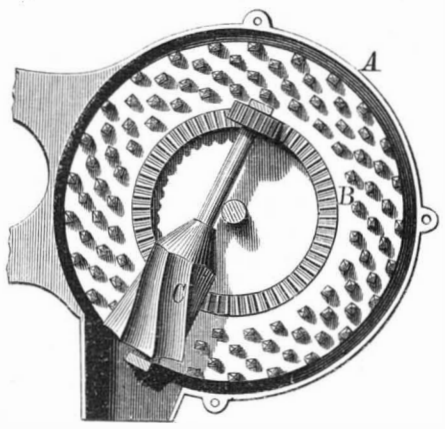
remains. B is a disk, having, about midway between its center and circumference, a circle of cogs which mesh into the pinion of the fluted roller. This roller, with its pinion, is cast all in one piece. Suitable bearings for it are bolted to the case, as shown.

The disk, B, is provided with annular rows of shelling teeth, as shown.

The corn is fed in as shown in Fig. 1. A spring (not shown), on the inner side of the case, holds the ears firmly against the disk, so that varying sizes of ears do not interfere with the operation of the machine.

The fluted roller revolves with greater rapidity than the toothed disk, the combined action of these two simple parts stripping off the kernels rapidly and thoroughly.

Fig. 2



Patented through the Scientific American Patent Agency, April 2, 1872, by Asahel H. Patch, of Hamilton, Mass., who may be addressed for further information.

To Purify Water.

Chloride of iron and carbonate of soda, in the proportion of 32 kilos. of the former salt and 84·5 of the latter to a quantity of water equal to 1,000 cubic metres, has been found a most valuable and quite innocuous means of purifying water, even such as is otherwise quite unfit for drinking purposes, and could not be rendered fit by alum. The salts alluded to are best previously dissolved in some pure water, and the solutions, that of iron first, poured into the tank containing the water intended to be operated upon. The soda solution is not added until after a few moments, the water being first vigorously stirred. The soda solution having been added, the fluid is stirred again, and then left quiet for the purpose of allowing the very bulky and flocculent sediment to deposit; this takes considerable time—from twenty-four to thirty-six hours. The *strychnos potatorum* is used in India for purifying clayey water.—*Chemical News*.

AMONG the remains discovered last year in Kansas by Professor Marsh and party were bones of the flying dragon. Professor Marsh judges that the dragons, to whom these fragments of bone belonged, must have measured, from tip to tip of their extended wings, some twenty feet.

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Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Lightning Strokes.

To the Editor of the Scientific American:

There is nothing more useful to the elucidation of a scientific matter than positive facts, especially where the matter in question is surrounded with so many various opinions as that of the lightning rod and its relation to thunderbolts. With as little preliminary verbiage as possible, allow me to say that Franklin never intended the lightning rod to catch thunderbolts. It was to prevent them. All electricians understand how; hence, when the rod is struck, it proves a failure. Some scientists claim for the rod the virtue of carrying off the bolt into the earth in a harmless manner, although the earth, moist earth, water if you please, is millions of times slower in its conducting capacity than iron or copper. Hence the rod may be called "the drop in a bucket" so far as its neutralizing the power of the thunderbolt is concerned.

There are some scientists who claim for the rod a power (an occult power) in its point, to neutralize the force of a thunder cloud when five miles off, because the rod at such times has been known to emit a spark when brought in proximity to the knuckle. They call it power of induction, for the want of a clearer definition. The same phenomenon applies to the human body, that is to say, at times the knuckle will give or take a spark to any piece of metal it may come near. As to the virtue of metallic points in neutralizing the capacity of a prime conductor of an electrical machine, so that it will not become surcharged, I find that any kind of point will do this; even a glass rod finely pointed will answer. I find also that the comb of the electrical machine may have its metal points all covered with glass sheaths and the sheaths pointed, and this will not prevent the prime conductor from becoming surcharged. In this experiment, the glass points present the phenomenon of illumination, as is the case with metal points.

And now for a few facts in the natural way; and in relating these I have no ends to subserve but those of science. They are the contributions of Nature in response to the investigation of the subject by the Meteorological Section of the Franklin Institute, and the writer was deputed by the Section to make diligent investigation of all this class of phenomena that may fall within his means of information.

During the past summer, twenty-nine cases of lightning came under my personal observation in the city of Philadelphia alone. While in these there appeared to be but little distinction as to the mechanical effects of the stroke, between those that were shielded with a rod and those that were not thus shielded, the damage and loss resulting from fire, as caused by the bolt, was in the cases that were shielded by the rod, and the fire was communicated to the buildings at points in proximity to the rod. I. P. Morris & Co.'s pattern shops in this city, and the Pekin woolen mills of Manayunk, were destroyed by fire; and if eyewitnesses are to be relied on, in both cases the sparks of fire were seen to scintillate from the rod. In five of the other cases, the buildings that were struck, although having no rods on them, were surrounded with buildings from the tops of which lightning rods were peering. Now since it is suggested that lightning rods should be brought into metallic connection with underground gas and water pipes, let us see how the matter stands, at all events with gas mains, as communicated by reliable persons. In Terre Haute, Ind., a thunderbolt struck the rod on a church steeple, tumbled the rod down, ran on to the gas pipes in the wall of the church, hurling brick and plaster outside and inside the building; then, after crushing the gas meter and igniting the gas, it ran on to the street main, following it for a distance of one thousand feet, bursting the joints of the main here and there along its line. Lead, being the material the joints were packed with, and it being a slower conducting metal than iron, was the cause of these bursts, occurring, no doubt, at those joints where the iron was completely insulated by the lead packing. Another case occurred in Indianapolis, and there, after it had done considerable damage along the lightning rod of a dwelling, it ran down and over four hundred feet of street gas main, and burned every particle of lead out of the joints, leaving, as the gas engineer of the works states, nothing but dross behind. Both these cases were communicated to the Franklin Institute Section by the intelligent engineer of these works. Another case occurred last summer in Iowa City, and was communicated to the Section by the Hon. S. E. Paine, mayor of that city. It struck the rod on a church steeple, tumbled it down, passed thence through a metal roof, on to a gas pipe in the building, following the pipes to the meter and crushing that, setting fire to the gas, and thence on to the street main, melting the lead packing out of the joints for a distance of four hundred feet.

From these three cases, we may have an idea of the proximate quantity of metal necessary to the dissipation or neutralization of a thunderbolt. Certain it is that the energy of a thunderbolt must find its equivalent of neutralization before it ceases to develop its projectile force. In my investigations I learn most unequivocally that the force of a thunderbolt is always destructive where it passes from a good to a bad, or from a bad to a good, conductor; and not only that, but when it passes from a small iron conducting surface suddenly to a larger one, it does the same thing. Where it flies from an ordinary lightning rod to so large an iron conductor as a six inch street main, it leaves behind it the marks of violent force.

I look upon these gas pipe cases as very instructive to the inquirer as to the behavior of the thunderbolt, whatever the elemental nature of its substance may be, and as establishing beyond a doubt that, in its projectile energy, it is in accordance with dynamic law.

Mr. David Brookes, a good electrical authority, says: If the rod is terminated upon an underground metal surface, equal in its area to the area of the building to be protected, no harm can befall such a building from a stroke of lightning. In regard to this, I have no question of its accuracy, but I would say, better cover the building with an iron or tin roof, and thus economise the matter. While I am not prepared to say positively that a metal roofed building cannot be injured by a stroke of lightning, I have never yet found one so roofed, in my fifteen years' investigation, that has been injured by a thunderbolt; and this is the case whether the roof was or was not connected with the earth by a metal conductor.

JOHN WISE.

Philadelphia, Pa.

Gravel Mining in California.

To the Editor of the Scientific American:

It may interest some of your many subscribers to know how gold mining is carried on in California at the present day. I would say something about gravel mining. What is termed gravel here consists of pieces of rock worn smooth by the action of running water. The size of the gravel varies from that of a head of a pin to a round rock that will weigh one hundred tuns. The gravel is found not only in the beds of rivers, creeks, and ravines where water is now running, but is also found on the tops of high mountains. On some of those high places, gravel is found from 1 foot to 500 feet thick. Under these beds in some places there is bed rock; and where the bed rock is hard, it is worn very smooth by the action of water and gravel rolling over it. In other places, the bed rock is very soft, and is worn down much deeper in some places than where the bed rock is very hard. In most places, the gold that is in the gravel is on the bed rock and mixed up with the gravel about 2 or 3 feet from the bed rock; and where it occurs thus, drifts or tunnels are run in between the gravel and bed rock to take out only that portion that will pay expenses.

Some of those tunnels are some two or three thousand feet in length, and have to be run that distance before striking gravel or seeing the color of gold. And I think there are enough abandoned tunnels, if put in a straight line, to reach from New York to San Francisco.

In those tunnels that prove a success and in which lots of gold has been found, and are yet yielding some yellow stuff from the bottom, there are railroads from end to end mostly of wood rails covered with iron. The cars that bring out the gravel from the tunnel hold from 1200 lbs. to a tun of gravel. When the gravel is brought out of the mine, it is passed through sluice boxes that have a stream of water running through them. The water takes off the gravel, and the gold remains in the bottom of the sluice box, and it makes one laugh sometimes to see a big chunk as large as a stovepipe hat. But most of the gold is found in pieces that weigh from one grain to ¼ ounce. How is it that a piece of gold, one eighth of an inch long, looks when in the water to be 1 inch long?

Plum Valley, Cal. G. C. P.

Testing the Strength of Materials.

To the Editor of the Scientific American:

In your journal of March 16, 1872, you publish and illustrate a machine made by the Colt Armory Company for testing the strength of metals. The idea of using an ordinary platform scale to measure the strain, that metal will bear up to the breaking strain, is claimed by Mr. Richards as his. This may be true as far as America is concerned, but it is not so here, as, about four years ago, I found it absolutely necessary to test the tensile strength of some rolled metals and wire; and, in looking about for the means to do so quickly and cheaply, the idea of modifying one of the platform scales in the works suggested itself, and this scale is precisely the same in principle as the one illustrated in your paper. To this platform scale I attached a graduated scale to show the length to which various samples of metal would stretch up to the point of rupture, and at the same time, show the number of pounds each specimen took to tear it asunder.

This modified platform scale answered the expectations fully, and I have had it in constant use for the last four years. It is well known here, as I made no secret of it.

JOHN ABRAHAM,
Per T. R. BAYLISS.

Adderley Park Rolling Mills,
Near Birmingham, Eng.

A HUGE TIME PIECE.—The four dials of the large clock at the English Parliament House are each twenty-two feet in diameter. Every half minute the point of the minute hand moves nearly seven inches. The clock will go eight and a half days, but it will only strike seven and a half, thus indicating any neglect in winding it up. The mere winding up of the striking mechanism takes two hours. The pendulum is fifteen feet long; the wheels are of cast iron; the hour bell is eight feet high and nine feet in diameter, weighing nearly fifteen tons, and the hammer alone weighs more than four hundred pounds.

RULES FOR MAY.—Warm weather is coming; we need less internal heat; and as this internal heat comes from the food we eat, we do not need as much food: hence, like a watchful mother, Nature takes away our appetite, so that we may not eat so much as before, to burn us with fever.—*Dr. Hall.*

[Reported for the Scientific American.]

SOCIETY OF ARTS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

MEETING HELD IN THE INSTITUTE IN BOSTON, APRIL 11, 1872.

The President, J. D. Runkle, in the chair.

A NEW FUSIBLE BOILER PLUG

was exhibited by Mr. H. P. Longley, which seems to obviate many of the difficulties met with in the use of the ordinary safety fusible plugs. The ordinary fusible plug has usually been found objectionable from the fact that after it has been in use for some time it will not melt at as low a temperature as when first put in. There are many cases on record of the exploding of boilers provided with fusible plugs, and of the crown plates of the same being overheated and distorted. To account for this, some have supposed that there was an actual elevation of the melting point of the metal, but the more probable cause is the oxidation of the metal, a crust of oxide being formed on the flat surface of the plug of sufficient thickness to prevent, to a considerable extent, the action of the steam upon the plug. The old plugs were usually placed in the crown sheet of the boiler, where they were exposed to the direct action of the steam or water on one side and the intense heat of the fire on the other.

The fusible plug exhibited by Mr. Longley is placed outside the boiler at a level a little below the lower gage cock, or it may take the place of this cock; it is so arranged that, when the plug melts, the water and steam will be admitted directly into the fire box, and extinguish the fire. The pipe in which the plug is placed is provided with a stop cock, so that the boiler may be used after the melting of the plug, and thus much delay be avoided.

Mr. McMurtie spoke of the advantage of having a reliable safety plug, and of the general disbelief in the usefulness of the plugs heretofore used.

An unrepealed law of the State of Massachusetts requires that every steam boiler in the State shall be provided with a fusible plug, but so nearly universal is the belief in their uselessness that it would be difficult to find a boiler with a plug properly inserted, or, indeed, with any plug at all.

Past experience teaches that there is no device which will fully take the place of care and watchfulness on the part of the engineer, and that where these are wanting, boilers will explode with or without fusible plugs. Several of the new plugs were blown out of a small boiler, in the metallurgical laboratory, after the meeting.

A NEW INJECTOR.

A new injector invented by W. B. Mack, and manufactured at the National Tube Works in this city, was exhibited by Mr. J. A. Grosvenor. This injector differs from others in having but one valve that has to be manipulated by hand; the waste valve is entirely automatic and requires no attention on the part of the engineer.

This machine is very compact, and its parts are few and simple; it contains but one valve besides that controlled by the engineer. One advantage, possessed by the injector over the ordinary force pump, is that it can be used, by locomotive or other boilers, while the engines are at rest.

A TURBINE WATER WHEEL.

A new diagonal turbine was exhibited and explained by the inventor, Mr. Libby, of Medford, Mass.

The chief advantage claimed for this wheel is that the lines described by the water in its passage through the wheel are as direct as possible; and thus the loss of power resulting from change of motion and consequent reduction of momentum is to a great extent avoided. The disk plate is cast in one piece, pitching in and downward to the axis of the wheel, at an angle of nearly forty-five degrees; the gate is cast in the same form, and conveys the water to the wheel in an outward and downward direction.

The water is discharged at right angles upon the curves of the buckets, which are of wrought iron.

The construction of the gate is such that a cushion of water lies between the disk plate and gate, so as to equalize the pressure upon the gate.

The superiority of this wheel in the points claimed seems to have been demonstrated by some experimental tests, made with this and several other wheels, by James Emerson, at Lowell, in Dec. 1871.

THE BLANCHARD BOILER.

At a meeting held March 28, Mr. McMurtie made a few remarks, illustrated by diagrams on the blackboard, on the Blanchard boiler. The general plan of this boiler is that of the fire box or locomotive boiler; the tubes, however, are so arranged as to form horizontal tubular diaphragms which divide the water space into three nearly separate compartments.

There is, strictly speaking, but one row of tubes; these connect with the upper part of the fire box, and are doubled upon themselves in such a manner as to traverse the length of the water space three times, forming the three diaphragms, and reach the smoke stack at the lowest and coldest part of the boiler.

The object which the inventor claims to have attained is great economy in the use of fuel; this is accomplished by reducing the temperature of the gaseous products of combustion to the lowest possible point before they are allowed to escape up the stack.

The temperature of the gases, when they reach the stack, is so low that a blower is required to produce the necessary draft. The length of the smoke stack has of course, no effect upon the draft and it may be as short as desired. The feed water is introduced at the lowest part of the boiler, and all vertical circulation is stopped as nearly as may be by the horizontal diaphragms, so that the heated gases are

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brought in contact with the coldest water last, and their heat utilized to the greatest extent.

Mr. McMurtie then gave an account of a competitive trial of this boiler with two ordinary tube boilers in Portland, Me. The Blanchard boiler had 830 square feet of heating surface, the others had 1,680; the former had 19·2 square feet of grate surface and the latter 38·7; so that the Blanchard boiler had less than one half the amount of grate and heating surface possessed by the other boilers. The Portland works were run with ease by the Blanchard boiler, although the two competing boilers had been found insufficient for the same work.

The temperature of the gases in the stack of the competing boilers was 720°, while in the Blanchard boiler it was from 200° to 250°; this shows the extent to which the heat is utilized by this boiler.

Mr. Miller said that the Boardman boiler was constructed on the same general plan as the Blanchard, and that the great objection to these boilers was that the different temperatures maintained in the different parts of the boiler tended to produce fractures of the shell.

PRACTICAL INSTRUCTION IN METALLURGY.

Professor Richards explained briefly the new metallurgical machinery recently erected in the Institute.

This machinery consists of a five stamp California battery, an amalgamating pan, a settler, and a Hendy concentrator. The machinery is essentially the same as that used in the best mills in Nevada and California, and is from the well known Union Iron Works of San Francisco. The battery may be used for either wet or dry crushing, and is provided with amalgamated copper plates for catching what free gold or silver there may be in the ore.

In the amalgamating pan, the ore receives a further pulverization, and this answers the double purpose, of liberating all the metal from the rock and of scouring and brightening the metallic particles so that they are in the best possible condition for amalgamating with the mercury, which is introduced in sufficient quantity to insure the amalgamation of all the liberated metal. The contents of the pan are warmed by the introduction of steam during the amalgamation. After amalgamation, the contents of the pan are run into the settler, where the amalgam and mercury are separated from the ore. The object of the concentrator is to separate the heavy and valuable portions of the ore, sulphurets, etc., from the gangue and quartz.

The Society then adjourned to the laboratory and witnessed the running of the machinery.

This laboratory contains all the appliances necessary to enable the student of mining and metallurgy to obtain a practical knowledge of the various processes of ore dressing, smelting, amalgamation, and assaying, used in the best metallurgical works of this and other countries. All the operations of the laboratory are conducted by the students under the supervision of an instructor. A student, on receiving a quantity of ore for treatment, first samples it and determines its character and value by analysis and assays, and makes such other preliminary examinations as may be necessary to indicate the proper method of treatment.

The ore is then treated, and the products carefully examined at each step of the process. He also keeps an account of the amount of power, labor, fuel, chemicals, etc., used, and thus determines the effectiveness and economy of the process.

The Institute has gold and silver ores from over seventy mines in Colorado and Utah, amounting in all to about eleven tuns. After the ores have been treated, reports are sent to the parties who contributed them, and it is hoped that this system of co-operation will enable the Institute to always have a sufficient quantity and variety of ores for the purposes of the laboratory. W. O. C.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW CASE HARDENING PROCESS.

A resident of Montreal has recently patented in the United States a new process of carbonizing wrought iron articles. Charcoal, coal dust, oil, bone dust, have each been used for this purpose; but strangely enough, one of the most highly carbonized substances, and one most easily accessible to an iron worker, has been overlooked. This is molten cast iron, and the inventor prepares a bath of it, having previously eliminated any phosphorus and sulphur it may contain. Spiegeleisen is especially recommended for the purpose; but good malleable iron, melted in a cupola with charcoal, anthracite or bituminous coal, or coke, will serve the purpose. Crucibles for melting small quantities, or reverberatory furnaces for large masses, may be employed. The cast iron readily yields its carbon to the immersed articles, and this element would rapidly become exhausted if no means are taken to continue a supply. To obviate this, the crucibles and furnaces are lined with a coating of charcoal powder or of plumbago with which nitrogenous matter has been incorporated. Leather or horn shavings will do for this purpose. If the process were carried out on a large scale, the cast iron from which the carbon had been eliminated could be at once sent to the rollers and made into bar iron, another melting being used for a second case hardening operation; and many other changes of detail will probably suggest themselves to our practical readers.

THE CHEMISTRY OF DYEING.

The great impetus given to many manufactures by the discovery of the anilin dyes is being daily augmented by newly invented processes. One of the most recent of these is an improved treatment of ultramarine, the desire of the discoverer (Carl Fürstenau) being to attain some degree of certainty as to the quality of the product. Fürstenau states that he has achieved this by fixing the compounds of the two sorts of ultramarine, commonly called, respectively, Nuremberg or clear blue and the alum-containing and inferior kind. By ascertaining the amount and character of the contained silicates, he finds out to what limit the reducing material can be used, and enables the operator to apply without hesitation the requisite degree of heat.

Clavel, of Basle, Switzerland, has published an account of the preparation of a new violet, obtained by heating magenta and iodide of ethyle without pressure. He calls it the "night violet," and obtains it by connected the apparatus with a glass tube, in which the iodide of methyle, as fast as it is volatilized by the heat, is recondensed and falls back as a liquid. The apparatus is a common cast iron boiler heated by means of a steam jacket. The cover has two openings for two glass tubes in connection with a worm for condensation. The vapors rising out of the boilers pass into the worm, are there condensed, and from thence runs as a liquid into the second glass tube which leads back the iodide of ethyle in a regular stream. For the preparation, he takes magenta crystals, solid caustic soda, and iodide of ethyle, with a suitable quantity of wood spirit; or the iodide of methyle can be used, and alcohol used as a solvent. The magenta and the soda are put into the boiler together, and well stirred till the mixture becomes uniform. Half of the iodide of ethyle is then added, the lid closed, and the condenser connected. Heat is now applied for six hours. The apparatus is then cooled, the remaining half of the iodide of ethyle added, and heating resumed for six hours more. After this time the connection between the condenser and the second or return glass tube is closed by means of a tap, and another tap is opened to allow the condensed iodide of ethyle to run off into a receiver. Heat is again applied, and maintained until all the iodide of ethyle and wood spirit are distilled over and preserved for use on another occasion. The mass which is left behind in the boiler is then taken out, and boiled for a considerable time with a strong lye of caustic soda. This removes all the iodine in the form of iodide of potassium, while the "night violet" is deposited as a cake. This is now in the state of an insoluble base. To render it soluble in water, it must be combined with an acid. For this purpose, the cake is dissolved in dilute sulphuric acid. When this has been done, the color is thrown down by neutralizing with a solution of soda. It is then washed in cold water, dissolved in boiling water, and finally reprecipitated by the addition of common salt. Unlike the ordinary anilin violets, which when seen by artificial light, seem of a reddish brown color, this dye retains its beautiful blue tone. A variety of shades may be obtained by varying the proportions of magenta, soda, and iodide of ethyle.

A FIFTH ATLANTIC CABLE.

Immediately following the announcement, published in our last issue, of the intended laying of a fourth Atlantic cable, being the second between this country and France, comes the publication in London of the prospectus of the Great Western Telegraph Company, Limited. It is thereby proposed to lay a new cable, constructed in the strongest and most solid manner, between the Land's End, England, and Bermuda, with branch cables from Bermuda, to New York and to the West Indies. The contract for the making and laying of the cables has already been signed, and a speedy execution of the work may be looked for. The diminution of the charges for transatlantic messages will soon follow the completion of these additional facilities.

MAGNESIA.

St. Claire Deville once exposed a piece of the hydrated oxide of magnesium (caustic magnesia) to a running stream of water; and he found after a few months that it had become hard as alabaster. He left it in the same place for seven years, and found that it had become still harder. Analysis proved this hardened substance to be nearly pure hydrate of magnesia. He conducted another experiment by stirring up caustic magnesia with water, and sealing the paste up in a glass tube. In a short time, the magnesia became transparent and proved to be a pure hydrate, containing 69·3 per cent magnesia and 30·7 per cent water. Deville at once saw the importance of these facts to cement manufacturers, and published for their information the following results of some experiments on the properties of caustic magnesia: A mixture of magnesia and sulphate of lime does not harden under water, but magnesia and pulverized chalk or marble will, by the action of water, form a hard stone or artificial marble. The magnesia which yielded the hardest stone was that prepared by heating the chloride of magnesium obtained from sea water. Care must be taken to prevent overheating, as a red heat will diminish the hydraulic properties of the magnesia. Dolomite, a magnesian limestone, which has proved so perishable under atmospheric influence, especially when carved into small spires and delicate tracery, is, correctly speaking, a double carbonate of lime and magnesia; and when this is heated, pulverized and mixed with water, it yields a substance of extraordinary hardness. These discoveries were known to and used by the late M. Sorel in the manufacture of his well known artificial stone; and they will probably be of use to those of our readers who are experimenting in this direction.

AN INTERNATIONAL POSTAL SERVICE.

We are informed, on good authority that a congress will be shortly invited by Prince Bismarck to Berlin, to discuss the desirability of instituting a system of international postal arrangements. Prince Bismarck will lay before the delegates the following resolutions: 1. That all the States of Europe, Russia in Asia, Turkey in Asia, Canada, the United States, and Algeria shall form a postal union. 2. That throughout this union, there shall be a uniform postal rate, for letters, of four cents per half ounce; and (3) that newspapers, printed matter, patterns, etc., shall be conveyed for two cents per two ounces. 4. That, to all countries not included in the Postal Union, double the above rates shall be charged. 5. The uniform registration fee for all parts of the world shall be four cents.

INCREASE OF INSANITY IN FRANCE.

Political disturbances have always been followed by many lamentable consequences; and the communistic outbreak in Paris is bearing terrible fruit. The *Lancet* informs us that the number of inmates in the lunatic asylums and *maisons de santé* of France has more than doubled in the last eighteen months; and the Paris Morgue is scarcely large enough to contain the bodies of suicides daily fished out of the Seine. Moreover, there is a marked tendency to insanity in the political prisoners now in durance at Brest, L'Orient, and elsewhere, the large proportion of two per cent being deranged.

The Government Architect.

The supervising architect, the man who has the primary direction of all buildings erected by the United States government, is Mr. A. B Mullet, a gentleman of extraordinary industry and ability. His official position gives him charge of all our post offices, custom houses, mints, assay offices, etc., both as to construction and repair, and the list of edifices he has planned and built is very large. There is the new State Department building, which will cost about six millions; the New York Post Office, at least four millions; the Chicago Custom House, not less than three millions; the Boston Post Office and Sub-Treasury, about $1,500,000; the San Francisco Branch Mint, one million and a half; and the Custom House at Portland, Maine, about $477,000. Add to the above a great series of edifices whose prices will vary from $225,000 to $395,000, and we can appreciate the enormous labor put upon this energetic and capable architect. The appraisers' stores at Philadelphia; the barge office at New York; the custom houses at Cairo, Knoxville, Omaha, Portland (Oregon), and St. Paul; a marine hospital at Chicago; court houses and post offices at Columbia (South Carolina), Des Moines, Madison, (Wisconsin), Springfield (Illinois), and Portland (Maine), all proceeding at the same time, show a rare executive spirit and capacity. Mr. Mullet is also putting up a series of buildings, which will cost from $20.000 to $80,000, at Astoria (Oregon), Bangor (Maine), Machias (Maine) Boise City (Idaho), Wiscasset (Maine), Charleston, New Orleans, and Baltimore, in some cases restoring and remodeling former edifices almost to the extent of complete reconstruction. To look upon Mr. Mullet is to see a rather small wiry, indefatigable gentleman, who can handle a hundred irons at once, work all day, and sit up the better part of the night; and it would be hard to find anywhere, in either ancient or modern times, a man who has built so much and with such general acceptability. Several of the best architects in New York competed with Mr. Mullet for the plans of the New York Post Office—the most costly edifice which has been erected by the Federal government outside of its own capital. The several plans are exhibited side by side in the architect's office at Washington: few persons fail to perceive at once the superiority of the government architect's; and we apprehend that no experienced eye can follow out Mr. Mullet's work, both in New York and Boston, and not see that, within the conditions of his office, he was probably the most available and versatile man that could be employed.—*Harper's Weekly.*

A New Method of Obtaining Potassium.

White stick caustic potash of commerce was dissolved in water and then treated with sulphuretted hydrogen in the way commonly described for making potassium sulphide, K_2S. The solution was evaporated until it was solid when cool, when the yellowish mass was mixed with more than its bulk of iron filings and chips, and the whole put into an alembic for distillation. The heat of a furnace was applied till the alembic was of a bright red heat, and the products of distillation were received in common coal oil. The product was rather small, as some of the potassium vapor decomposed the heated vessel; nevertheless the potassium showed itself, when the oil was poured off and the residuum turned upon water, by its characteristic ignition and flame. The reaction is simple and may be thus represented: $K_2S + Fe = FeS + K_2$.

I have not conveniences for experimenting upon this on a scale large enough to test its comparative value; it needs some special arrangement of protected vessels, as it violently attacks common crucibles, porcelain, and glass. The materials used for thus obtaining it are of the required cheapness, and the iron sulphide product can again be used to furnish sulphuretted hydrogen for another quantity.

It is probable that sodium can be obtained by analogous process, but I have not attempted it.—*Professor A. E. Dolbear, in the American Chemist.*

Explosive Pills.

Some pills prescribed by a physician in England contained: One half grain nitrate of silver, one sixth grain extract nux vomica, and one half grain muriate of morphine, together with *Cons. ros.* and extract of gentian. They exploded in a very short time, evolving a considerable amount of heat. A similar case occurred in the practice of Dr. Jackson, of Nottingham, England, who prescribed pills containing four grains of nitrate of silver, one grain muriate of morphia and extract gentian. The lady patient, who had the box about her person, was badly burned by the explosion. Pills containing nitrate of silver and creosote or carbolic acid become heated, and even take fire. Of course, when chlorate of potash is employed the explosion is much more violent.

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Massey's Rotary Steam Engine.

While in common with most engineers we have conceded the theoretical value of well constructed rotary steam engines, the practical difficulties connected with the realization of an ideal engine of this class have seemed to us well nigh insurmountable. The advantages claimed for the rotary over the reciprocating engine are cheapness, lightness, compactness, and simplicity. If, therefore, the inventor of the engine, here illustrated, has produced an engine which in point of economy of fuel is equal to the reciprocating engine, either of the above points, alone, will insure the success of his invention. For locomotives one rotary engine can be made to do the work of two reciprocating engines, as in the rotary there are no dead points or variation in leverage as in the reciprocating engine. For marine purposes, it is desirable on account of compactness and lightness, and for stationary purposes more particularly on account of cheapness and simplicity.

Up to the present date, no rotary engine has been produced that could approach, in economy of power, the best types of reciprocating engines. The reasons for this have been found in the large amount of clearance in such as use steam expansively, in the great friction upon the journals of the shafts and upon the packing pertaining to almost all of them, and in the leakage caused by wear which occurs in most of them. We have recently published articles on this subject, and therefore need not dwell upon these principles in this connection.

The inventor of the rotary engine herewith illustrated has grappled intelligently with these difficulties, and although, in the absence of competitive tests with engines of the reciprocating class, it is impossible to assert positively what measure of success he has attained, we can say that, from examination of the engine in the performance of actual work and close scrutiny of all its details, we think he has approximated very closely to such perfection as may legitimately be hoped for in a rotary engine.

At first sight, those familiar with what has been done in this field of engineering, might be led to think the inventor had been following a beaten track, and perhaps that the improvements he has adopted were such more in name than in reality. It will be found, however, that very important ends are subserved by seemingly small changes in construction.

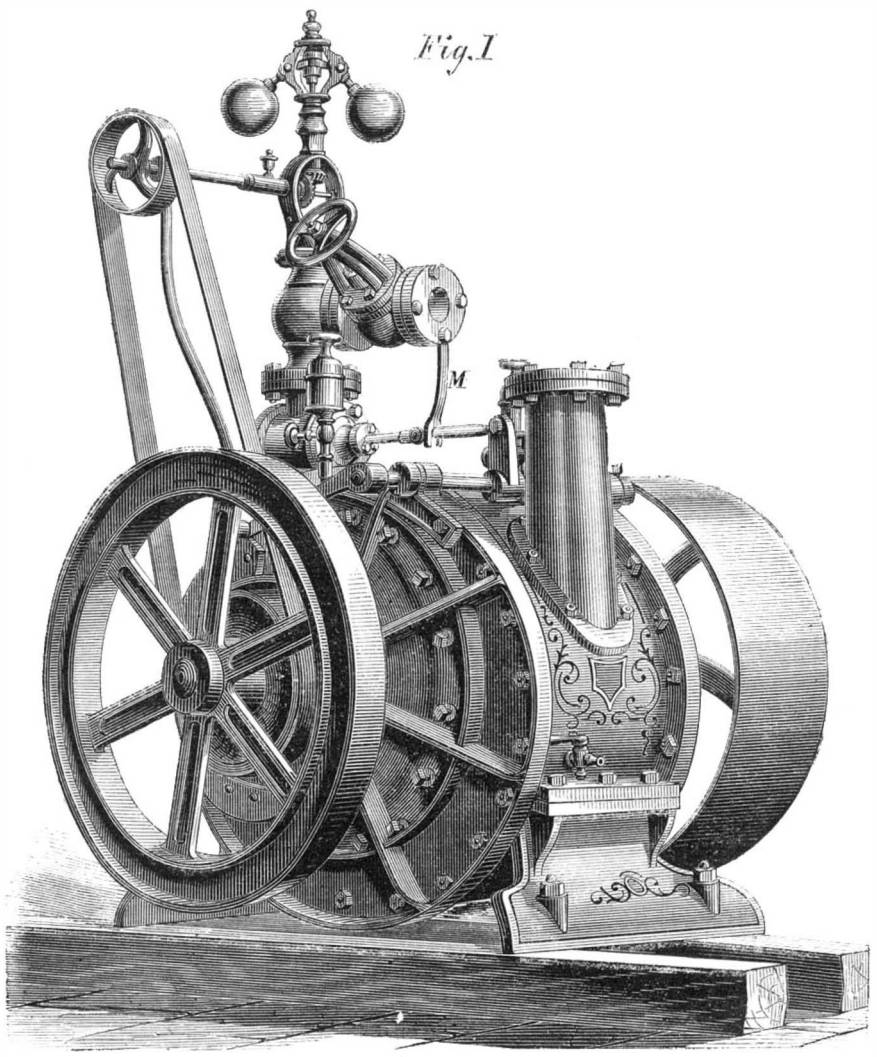
We have long maintained that what has generally been considered as the chief difficulty in the construction of rotary steam engines, namely, the keeping of them thoroughly packed without undue friction, was not really the greatest difficulty, nor one that ought to defy the mechanical genius of the present age. A greater difficulty has been, in our opinion, that of using steam expansively with a variable cut off, and without undue clearance. In this engine, as represented in our engravings, the variable cut off is lacking. The inventor, however, claims to have supplied this want—and from an examination of his drawings we are led to believe he has—with a device which, for good reasons, he does not yet wish to make public.

Fig. 1 is a perspective view of the engine, and Fig. 2 is a vertical section illustrating the interior construction. A is the induction port, and B the exhaust. A cam, shown in dotted outline in Fig. 2, actuates the bell crank lever, C, which is pivoted to the stem of the balanced piston valve, D. The exterior case or cylinder, E, is oval, and within it rotates, upon the shaft, F, the drum, G. The pistons, H, are actuated by fixed cams, I, formed upon each inner side of the case, their relative positions at the beginning and end of the stroke being those shown in the engraving. These moving parts are rendered steam tight by spring metallic packing at the ends of the pistons where they meet the exterior case between the points J and K. The sides are rendered sufficiently tight with minimum friction by scraping. At the top is placed a metallic abutment or septum, L, which is packed with a metallic spring packing, like the ends of the pistons. This abutment is pivoted at the middle, as shown, and is prevented from bearing too heavily upon the perimeter of the drum by the action of a set screw placed on the side opposite to the induction port.

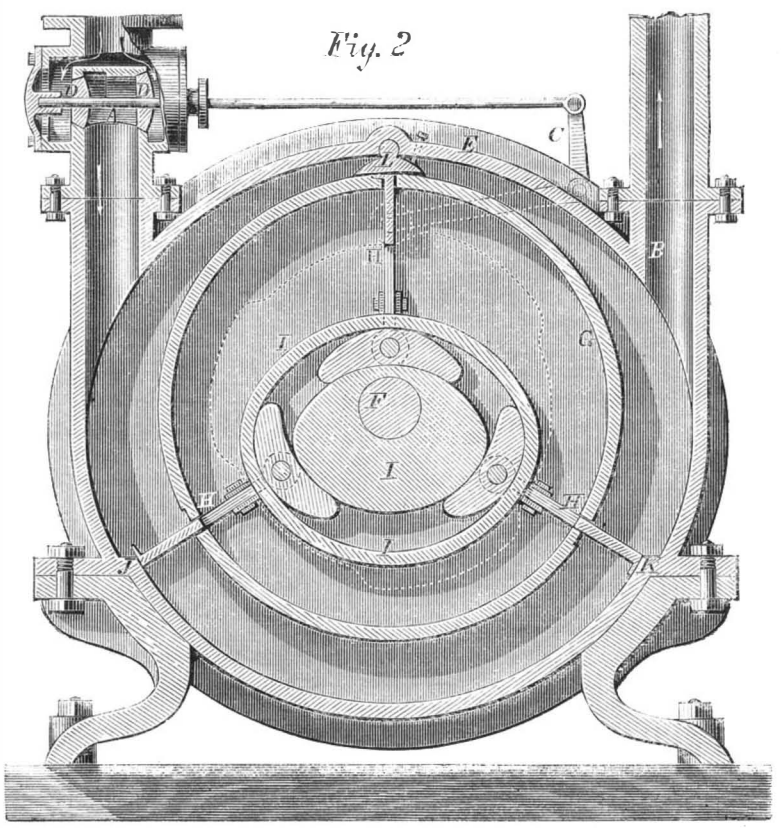
The valve is actuated, as above stated, through the cam, shown in dotted outline in Fig. 2, acting upon the horizontal arm of the bell crank lever, C. This cam is adjustable to let off the friction roller in the end of the horizontal arm of the bell crank lever at any point of the stroke. The spring, M, Fig. 1, then acts upon a collar on the valve stem to close the valve and make a sharp cut off.

The operation, therefore, of this engine is as follows: Steam entering at A fills the space between J and L, and accumulates till the pressure is sufficient to start the engine, which commences to rotate The steam being then cut off at the proper point, the steam in the space between J and L, and that following the piston in the space between J and K, expands, till the next succeeding piston reaches the point, J, at which time the exhaust of the expanded steam also takes place, the entering piston meeting the ledge at J, and the outgoing piston leaving the ledge at K. The steam now being admitted again compresses the expanded steam in the space, J L, increasing its pressure rapidly but without shock upon the entering piston until the point of cut-off is reached, when the expansion is repeated. It will be seen that all the steam which escapes from the exhaust is expanded steam, contained between the points J and K, and that therefore this engine has no clearance, and may be instantaneously stopped and reversed, by a very simple valve motion, when required to transmit power in both directions.

The fixed cam, I, does not move the pistons during their passage through the arc, J, K; at all other times the pressure is equalized on each side of the pistons, and consequently they are thrust out and in with slight expenditure of power.



MASSEY'S ROTARY STEAM ENGINE.



It is proposed to at least partially balance the pressure, upon the journals of the main shaft, when the engine is applied to locomotives by the weight of the locomotive itself, and in stationary engines to relieve in a measure this pressure by leading off the power in the proper direction from two pulleys, one on each side of the engine. This will reduce the friction and wear of the bearings. The possible wear is still further reduced by making these bearings of steel, and a compensating device for taking up such wear is employed.

The engine from which the engravings were made has at the exterior arc, J K, a radius of 18″, the interior arc between the points being 14″. This gives a mean radius of 16″, and a mean stroke of about 33″. The piston surface is 18 × 4.

Patented through the Scientific American Patent Agency, February 13—two patents—and April 16, 1872, and also in several foreign countries. A joint stock company has been organized under the title of the "Massey Rotary Engine Company." Office, 56 Broadway, New York city, with manufactories at Paterson, N. J., and St. Louis, Mo., where engines of various sizes are now being constructed.

For further information and illustrated price list, address G. B. Massey, Secretary, 56 Broadway, New York, or Wm. Massey, Supt., care Crow, McCreery & Co., St. Louis, Mo.

Gun Making by Machinery.

A correspondent, Mr. B. F. Spalding, of New York city, in commenting on the description of gun making by machinery, recently published in our columns, points out that gun stocking machines, such as are mentioned in that article as being in use at Enfield, were made by the Ames Company, at Chicopee, Mass., fourteen or sixteen years ago; and similar appliances had been used, at Springfield, twenty years ago. The system was the invention of Thomas Blanchard and Cyrus Buckland, and other well known American mechanics. "This machinery," he continues, "has been duplicated time and again; and Russia, Spain, and, I think, Turkey and France, have each had sets of it made at the Ames works. The great perfection at which this branch of industry has arrived is mainly due to the idea of making the work to gages, so that the parts would interchange; and this principle is being every day introduced into other manufactures, such as sewing machines, watches, steam engines, etc. This idea is said to have been conceived and first put into practice by Thomas Warner, at that time master armorer of the Springfield Armory, under the superintendence of Colonel James Ripley, late Chief of Ordnance, U.S.A. Mr. Warner has never received any recognition of his valuable services from Government, but is now, at nearly 80 years of age, whether from choice or necessity, at work for days' wages at Chicopee Falls. It is like going to a play, to a modern mechanic, to hear some of the old patriarchs, at Springfield, relate their experience in the wilderness, while wandering ever towards the promised land, where the ripened fruits of ingenuity—clusters of Eshcol—should drop from perfected machinery into the hands of perfected mechanics. For instance, in regard to this very machinery, it is said that when Blanchard, while yet young and ardent, and with a rising reputation, had just got some little machine at work on something not connected with stock making, there were quite a number gathered together, looking to see it perform its automatic operations. One of the stock makers sneered, and said, tauntingly, 'Oh, you may get up some little improvements, but you can never make a gun stock by machinery.' The crowd laughed at the wit, but Blanchard replied, 'I don't know about that.' And the taunt worked on him like yeast, and kept his brain in a ferment, until it evolved the principle of irregular turning, by revolving cutters to the shape of a revolving former, a principle now in general use.

"In a later article, mention is made of the process of bayonet rolling in Ilion; and that reminds me of Harvey Waters' curious and ingenious machine, now in the Springfield armory. Other bayonet rolling processes have the blank prepared, and then a man passes it through the rolls. His machine takes the piece of bar steel, heated red hot, into its iron hand, and passing it from groove to groove, finally holds it out, a smooth shining blade, so near the size required that it only needs the touch of the grindstone to put it into its finished form. I lost about $3,000 waiting for Harvey to perfect that machine; but he has a good one, well worth an extended description.

"There are wonders to be seen and heard in the Springfield armory, and it would pay to send an able reporter there.

"It is certain that the sewing machines could never be made for $12 each, if it were not for the system of gage work and interchangeable parts devised by the old man Warner (a fine old man he is, I assure you), for which grand idea he never has realized anything. Moreover, most of the machinery that makes the work on these machines so cheaply was incubated at the Springfield armory, and most of the perfected mechanics, directly or indirectly, received their education from there."

A COMMUNICATION has been made to the Philosophical Society of Manchester on the destruction of a church by lightning, in which clear particulars are given of the metallic connections, and of the behavior of the shock when it fell. The author states, in closing his paper, that in districts where gas mains, and water mains and pipes are laid underground, all buildings may be entirely protected by connecting the lightning conductors directly with the two sets of mains. Had this been done, he says, at the church in question, it would not have suffered.

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Importance of Advertising.

The value of advertising is so well understood by old established business firms, that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 40,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

DRYING SUBSTANCES BY MECHANICAL ACTION.

As we have said in former articles, the desiccation of substances may be effected, at least to a certain extent, solely by mechanical agencies. In these, we include all means whatever which do not involve material change of temperature, or chemical action. Prominent among them stands a class of substances which may be called absorbents. These act through their adhesive attraction for water, and therefore can only be useful when such attraction is equal to or greater than that of the substance to be dried. Thus, if it were attempted to dry fragments of glass by the use of powdered resin, the result would be failure, as the glass attracts water powerfully while the resin does not.

A familiar example of drying by absorption is found in the use of blotting paper. This paper, being made porous and not being sized, attracts moisture and absorbs it far more powerfully than hard and sized writing paper, The former, therefore, will soak up and remove the greater part of a drop of ink from the surface of the latter. Chemists often use blotting paper to dry moist powders, precipitates, etc. So jewelers use boxwood sawdust for drying gold and silver ornaments that have been cleansed with soap and water. Sawdust in general is a good absorbent, and may be used to dry metallic objects, after their immersion in sulphuric acid for the removal of scale, etc.

Straining or filtering is another way of separating solids from liquids, but this rarely leaves the separated solid so dry that it needs no further desiccation.

A much more important process of mechanical drying is compression. This method is employed in many industries, sometimes to remove a waste liquid from a valuable solid, and oftener, perhaps, to separate valuable liquids from solids of less importance. The extraction of the juices of fruits for wines, cider, perry, etc., is thus performed; and although in the extraction of beet juice, maceration is practised to a greater or less extent, the press is still, we believe, most generally used.

In applying the press to the separation of liquids from solids, considerable skill and judgment are required. The fluid has to make its way, through innumerable small and constantly narrowing channels, to the exterior; and this is a work of time. To hurry it unduly will cause a waste of power, and often a deterioration of the product, by the expressing of essential oils and extractive principles which it is not desirable to remove. Thus castor oil is often found to contain an excess of a peculiar peppery, acrid principle, which has, through the action of heat and too rapid compression, been forced out with the oil from the ground beans. In the drying of textile fabrics by wringing or compression, much power is often needlessly expended by hurrying the process too much at first. In the wringing of wet goods, the texture is itself the press. In those machines, erroneously called wringers, which remove water by the use of compression rollers, the pressure is advantageously applied successively to different parts of the texture, and these machines constitute some of the best appliances for the drying of woven and knitted fabrics, yarns, etc.

Another very effective means of drying not only such fabrics but other substances, as sugar and the like, consists in the employment of centrifugal force. The substance to be dried is put into a circular revolving cage, of wire gauze or its equivalent, the meshes of which, while retarding the outward motion of the solid, do not obstruct that of the liquid which, by the rapid motion, is forced out and thrown off the exterior of the cage. This is a process of straining, centrifugal force being substituted for gravity. The water adhering to the interior of a bottle may be removed by making use of the same principle. The bottom of the bottle being held in the hand, if the bottle be rapidly swung around by the arm, as on the end of a spoke of a wheel, a few revolutions will impel all the water along the inner surface of the glass till it reaches the mouth of the bottle, from which it will be thrown through the action of centrifugal force. These centrifugal machines have been much employed of late. They are used in Cuba for drying sugar, to a great extent, and have proved very serviceable in many other industries.

THE CONGRESSIONAL SEWING MACHINE JOB.

The application made in the name of A. B. Wilson, to revive his expired patent for sewing machine feed, is still pending before Congress. The evidence presented before the Committee reveals some curious facts.

It appears that Wilson sold out all his rights in this extension some time ago, to Wheeler and Potter, the sewing machine millionaires, and this Congressional application is now being prosecuted in their interest and that of their associates composing the Sewing Machine Ring. They hope by the aid of Congress to get this patent of Wilson extended; and should they succeed they will be enabled to continue the enormous monopoly which, at the expense of the poor, yields them great wealth.

The evidence produced by the remonstrants, by affidavits of competent machinists in different parts of the country, shows "that the actual cost of making the sewing machines of the best quality now in the market need not exceed twelve dollars, and at fifteen dollars they will afford a very handsome profit. The figures taken from Singer's accounts, sworn to by him in 1870, prove that the machines made by that company from 1865 to 1871 cost less than twelve dollars, ($11.83), and they are sold to the public at not less than fifty-five dollars each. The aggregate of profit which must have accrued to the combination and their licensees is enormous. The number of machines, as stated in the evidence on Wilson's behalf, for seven years past is 1,882,479, at an average profit of thirty dollars; on the machines alone, not counting the profits on materials and on ornamented cases, etc., the enormous sum of fifty-five millions of dollars has been extracted from the pockets of the people, over and above a fair manufacturing profit.

The Ring have not improved their machines in any material points; they have made the same styles for fifteen years. They have added devices for hemming and filling, etc., but for these they charge generally an added price, and they have adopted only such improvements in these as they saw fit. The testimony is ample that the machines themselves are not substantially different from what they were fifteen years ago.

No better summing up of the whole matter can be given than is found in the decision of the Hon. S. S. Fisher, made by him in 1870, upon an application of Singer for an extension of a patent for his earliest invention. Mr. Fisher had been for many years familiar with the whole sewing machine controversy; he had also been of counsel for the combination in several of their suits, and as an intelligent and upright judge, he decided that Singer's patent, and others like his, ought not to be extended. He says at the close of his opinion:

The interest of the managers of the licensed sewing manufacturing concerns, who, six at least in number, have made affidavits for Wilson, or rather for the combination in this case, leads them to demand protection for their profits; but the interest of the public, and of hundreds of inventors whose improvements could not be used by them while this Wilson patent stood in their way, imperatively require that 'all barriers to a free manufacture and sale shall be broken down as speedily as possible, consistently with individual rights.' When they have fallen by lapse of time, Congress should not aid in building them up anew.

More than one thousand patents have been granted, since the original issue of this Wilson patent, for improvements in sewing machines, and more than five hundred in addition for special devices for hemming, felling, gathering, and cording on sewing machines; and only a few of these, which the combination have graciously condescended to buy or to license upon their own terms, have been allowed to be tested by use or to be put into the market for the benefit of the public. The inventors could not use their own improvements without machines to attach them to, and they have been forbidden to make the machines. The average cost of these patented improvements, in cash expended by the patentees in fees to the Patent Office, in models and drawings, and to the patent agents for preparing applications and specifications, can hardly have been less than $250 in each case. All of them have, if the Patent Office has done its duty, some points of novelty and value, and have been adjudged by the Government to be worthy of protection by patents. These inventors, besides the time given by them, have thus paid nearly four hundred thousand dollars into the Treasury of the United States, and the combination, through Wilson, now asks that there shall be no opportunity for them to receive any return therefrom, except at their good will and pleasure, for seven years longer. A large proportion of these patents will expire before the seven years will end, and thus a practical confiscation of them will be enforced, if Congress yields to the pressure of the monopoly.

The public interest requires that when an article has come into general use all barriers to its free manufacture and sale should be broken down as speedily as possible, consistently with individual right. If an inventor has produced a good thing, but the public are slow to perceive it: if he is obliged to spend the greater part of his original grant in preparing for its manufacture, in slowly bringing it to the public notice and in demonstrating its utility, and if it appears that, at the expiration of his first term, if the exclusive right is taken away from him, it is probable that all incentive to further exertions is likely to be destroyed, and no one else appears ready to step forward and take his place, it is obvious the public interest might demand an extension of the patent. But when an invention is used in thousands of households and is wanted in thousands more, the public interest equally demands that the inventors of the first crude forms of the implement, especially if they have already realized hundreds of thousands of dollars under their original grant, shall stand aside and permit the machine to be cheapened and improved by those whom they have shut out of the market. This wall of exclusive privilege has stood long enough in the way of those whose improvements and exertions would doubtless speedily diminish the cost of the machine one half or double its value to the purchaser."

PROGRESS OF ASTRONOMY.—THE VARIABLE STARS.

Next to the application of the spectroscope to practical astronomy, the use of the photometer promises to be of the utmost importance. We have often referred to these important tools of the scientist, and will now only mention one, of recent invention by Zoellner, of Berlin, Prussia, which in fact is a polariscope connected with a telescope. In the so-called polariscope, a ray of light may be made to disappear and reappear alternately, by turning an eye piece of Iceland spar, tourmalin, or other proper material around its axis, through an angle of 90°. This disappearance and reappearance is gradual, and the angle of rotation from 0° to 90° may therefore be used as a measure of the intensity of the light, a stronger light requiring more rotation, to be toned down to a certain standard, than a weaker light. The principle on which this instrument is based is the property of light that, when once reflected under certain angles or refracted by certain media, it becomes incapable of being reflected or refracted again except under certain conditions; the rotating eyepiece of the polariscope procures an alternation of these conditions, and therefore it is equivalent to a measure of light.

The results obtained by Zoellner, in measuring the relative luminosity of heavenly bodies may be summed up thus: Taking the light of Capella as the standard of measurement, or = 1·

PLANETS.	
Neptune	0·0007
Uranus	0·0066
Saturn	0·4
Mars	7·0
Jupiter	10·0
Venus, when full	48·0
FIXED STARS.	
Pollux	0·3
Regulus	0·4
Betelgeuse	0·5
Capella	1·0
Vega	1·2
Sirius	5·0
The light of the sun	55,000,000,000·0
The light of the full moon	10,000·0

In regard to the comparative amount of light given by stars of different magnitudes, when taking as a unit the telescopic stars of the ninth magnitude, we have:

Telescopic	star of	the	9th	magnitude	equals 1
"	"		8th	"	" 2·5
Visible	"		7th	"	" 6·0
"	"		6th	"	" 15·0
"	"		5th	"	" 48·0
"	"		4th	"	" 120·0
"	"		3d	"	" 340·0
"	"		2d	"	" 960·0
"	"		1st	"	" 2,700·0

The most interesting result, however, of these measurements is the determination of the periods of the variable stars, and the intensity of their light at different periods. The first astronomer who noticed a variable star was Fabricius, in 1596; he saw a star, in the constellation *Cetus* entirely disappear, while Holwarde, in Franeker (Netherlands), discovered that there was a regular periodicity in its reappearance, and that its period was 331 days and 20 hours. It is the most remarkable of all periodic stars, as the intensity of its light during this time varies from 1,000 to 1 or 0, showing for about two weeks as a star of the second magnitude, decreasing for three months, remaining invisible for five

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months, and increasing again for about two months and a half. There are, however, irregularities, in the degrees of brightness, it attains which are also periodical; and another remarkable fact is that, when decreasing, it changes its color from white to a full red, which is a problem for spectroscopic investigation, not yet explored.

In 1669, Montanari observed the variability of Algol, in *Perseus*, which, among the variable stars, possesses perhaps the shortest period. For 7 hours in every 68 hours, it undergoes a gradual decrease from an intensity of 800 to 120, or, from a star of about the second magnitude to the fourth; then a slow decrease till the minimum intensity is reached, which lasts only 18 minutes; then an increase sets in, till, some 30 hours later, it has attained its first splendor.

Goodricke discovered in 1784 that a star in *Cepheus* changes, in 5 days and 9 hours, from the third to the fifth magnitude; it takes only 38 hours to become bright, while the decrease lasts 91 hours. In *Lyra* is another variable star, which varies every 13 days from the third to the fourth or fifth magnitude; while in *Cygnus*, there is a small star which disappears entirely every 406 days, and at its maximum brightness has from the fourth to the seventh magnitude.

The most remarkable of all temporary stars was seen in 1572 by Tycho Brahe; it appeared suddenly on the 11th of November, in the constellation of *Cassiopeia*, and reached very soon the brightness of Sirius; then it increased slowly till it surpassed even Jupiter and could be seen during the day. In December of the same year, it commenced to diminish in luminosity, and disappeared at last in March, 1574, sixteen months after its first appearance. At first it was white, in March, 1573, it was red, and in January, 1574, again white. From private astronomical records, it appears that, in the years 945 and 1264, a bright star appeared at the same spot, and therefore some astronomers hold that this is the same star, which has a periodicity of 313 years. If so, it will again appear in 1885. Kepler observed a similar star which appeared in October, 1604, and soon reached the brightness of Jupiter. It soon diminished, and in January, 1605, was still as bright as Arcturus; but in March, 1606, it disappeared entirely.

The record of a certain star in the constellation *Argus* is remarkable. It was seen by Halley in 1677 as one of the fourth magnitude. In 1751, Lacaille observed it as of the second magnitude. In February, 1827, it had increased to the first magnitude, but returned soon to the second, till 1837. In 1838 it increased in brightness till it became equal to the third star in the heavens, then it diminished, but not below the first magnitude, until April, 1843, when it increased again till it equaled Sirius in splendor. Then it diminished, till in May, 1863, it was scarcely visible to the naked eye; and now, in 1872, though it seems to have commenced again to increase, it is still of only the sixth or fifth magnitude.

On May 12, 1866, a new star of the second magnitude was suddenly seen in the constellation of the *Corona Borealis*, in the place of a telescopic star of the tenth magnitude; it was investigated by Huggins with the spectroscope, and he found that, besides the dark absorption lines similar to those found in the light of our sun and produced by its atmosphere, there was another spectrum of four luminous lines, as produced by our flames. The conclusion which was drawn from the observation was founded on the fact that three of these lines were perfectly identical with those of hydrogen when illuminated by the electric spark passing through it. Thus the star had suddenly become so bright by the evolution of luminous hydrogen, probably burning; therefore it was predicted that it would soon diminish, as such an enormous conflagration could not last forever; and this was actually the case. First the hydrogen lines disappeared in the spectrum, and the star had, on May 20, already fallen below the sixth magnitude, while it sank soon to the tenth, as before. Since that time it has fluctuated slightly. In 1870, it was of the seventh magnitude, and is now, in 1872, of the eighth, and thus invisible to the naked eye.

The temporary stars which disappear totally are very rare; during the last 2,000 years, only some twenty have been recorded. The variable stars which do not entirely disappear are scarcely more numerous; their number thus far recorded is twenty-four; but by the greater perfection in the photometers by the application of the polariscope, there is no doubt but that observations will reveal a great number of slight fluctuations which have thus far escaped notice. Our sun itself is a periodical star of which the time is eleven years, this being the period of a greater or less number of sun spots. In other stars, the periodical number of spots is larger, or they have a companion, which is darker and periodically eclipses the main star. The hypothesis of double stars revolving around a common center of gravity, one being light and the other darker or perhaps non-luminous, is now being adopted by the most advanced astronomers.

ARTESIAN WELLS AND MALARIAL FEVERS.

We recently noticed the connection of water obstructions with the increase of malarial disease in the Eastern States. A cognate subject is the increase of similar complaints through causes connected with artesian wells. The leading article in the *Georgia Medical Companion* for January, discusses this subject at length, attributing the great increase of malaria in certain districts to wells of this kind

It appears from this article that, although physicians and the people at large have striven to shut their eyes to probable injuries arising from the artesian system on account of the many advantages it possesses, they are finally compelled to acknowledge that the wells are operating disastrously upon the sanitary condition of the regions where they are most numerous. We quote a paragraph or two which sets forth the magnitude of the evil:

"The military and Hamilton roads, which converge at Columbus, Lowndes county, Miss., are the oldest roads in that section of the State, and, as they passed through a productive agricultural region, were early settled and well improved. This section of country was never regarded as sickly, even when the lands were first opened. But since 1841 or 1842, or since the introduction of artesian wells, which are found at almost any homestead, malarial fevers have so increased in severity and prevalence that almost all the entire male population of the early settlers are dead, and the country is owned by a remnant of widows and by new settlers.

The increase and severity of the fevers has also been observed in Pickens and Green counties, Alabama, in which these artesian wells abound. The Subute, Lipsey and Black Warrior counties have become more and more unhealthy, and of late years a new and virulent form of malarial disease, called yellow disease, or hæmatural intermittent fever, extremely fatal, has been developed, and upon inquiry found to originate in the vicinity of these same artesian wells.

This ugly disease has extended into this section of Mississippi, and with singular uniformity sticks closely to the bored well neighborhoods. In fact, so common is the occurrence that in the absence of some very obvious source of malarial poison, the physician inquires at once for an artesian well. A conversation, with a number of the members of this society, reveals that at least 7-10 of all their cases of yellow disease, particularly the fatal ones, occurred on premises containing artesian wells.

The same is true, also, of that aggravated form of algid congestive fever, which prevailed at the first settlement of the country, but which had almost entirely disappeared. It is found reappearing in these artesian well neighborhoods.

Any place very sickly, more so than the surrounding settlements, is very apt to be distinguished by the abundant overflowing well located thereon. The northwestern portion of Columbus—the sickliest portion of the city—contains most bored wells, and until an artesian well ran out in the main street of the city, chill and fever among the clerks and young men was almost unknown. Since that time they have been very prevalent."

The causes for this serious evil are various, but all are considered to be traceable to the wells as their source. First, a large portion of the waters flowing from the wells is impregnated with iron. While chalybeates have always been considered the most healthy of all mineral waters, how far their continued constant use may debilitate the system and fit it for the reception of malarial poison, is a question not answered. Like other stimulants, they may produce a resultant depression, or they may by protracted use produce other obscure effects, as the magnesian limestone springs of Switzerland produce cretinism and goitre.

These surmises may well lead to further investigation, but there are more direct influences connected with artesian wells not so difficult to connect with the diseases in question. Artesian wells constantly flowing necessarily bring to the surface a large amount of moisture, which in the heat of southern climates facilitates vegetable decay, all the more since the mineral character of the waters causes them to deposit deliquescent oxides and salts which retain moisture. The fact that districts which abound in mineral waters of this kind are generally subject to malarial fevers has been observed without the inference that artesian wells would be likely to set up a similar set of conditions.

If this increase of vegetable decay be, as seems probable, the chief cause of malaria, a remedy for it without foregoing the advantages of the artesian system seems difficult to suggest. It appears that the old saying "there is no great loss without some small gain" may be reversed in applying it to many of our attempts to ameliorate the condition of mankind.

A SUGGESTION TO INVENTORS.---VALUE OF PATENTED IMPROVEMENTS UPON PATENTED INVENTIONS.

A certain proportion of useful improvements is found upon examination to be temporarily unavailable to their inventors, because they can only be used in connection with other inventions already protected by letters patent. On this account, inventors often neglect to procure patents upon such improvements, though many of them are of great value and would ultimately prove remunerative.

To illustrate this: Suppose a man were to perfect an improvement which should increase the utility of any one of the popular mowers and reapers now in use. The proprietors of the machine would not be slow to see the value of such an improvement, and, knowing that it would better enable them to compete with the manufacturers of rival machines, would be willing to pay a reasonable price for the privilege to apply the invention. This is one way in which inventions of this class prove valuable when patented.

Suppose, however, that an invention is made of a combination of devices which work well together, yet among which is found something covered by another patent, and without which the improvement is valueless. In this case, investigation often shows that the obstructing patent has only a small portion of its term to run, after the expiration of which the new invention, if patented, may have twelve, eight, or six years of uninterrupted prosperity.

Such being the case, in securing a patent the latest inventor avails himself prospectively of a valuable franchise, which it were the hight of folly to neglect simply because it cannot be made immediately remunerative.

Great loss is annually sustained by such neglect. We can call to mind numerous improvements now meeting with large sale, which pay nothing to their inventors in consequence of such neglect, yet which would, if patented, for some years to come make large returns to those whose ingenuity and thought produced them. Let inventors remember that, although "a bird in the hand is worth two in the bush," a bird in the bush is sometimes a most valuable bird, worth a good deal more than it costs to secure him.

CABLE TOWING ON THE ERIE CANAL.

In addition to the offering of a reward of one hundred thousand dollars for an economical motive power for canal boats, heretofore noticed by us, the Legislature of the State of New York, by an act passed in 1870, authorized the laying down of traction cables in the canal, for the purpose of propelling boats on what is known as the Belgian system. To effect the desired propulsion, the cable is made to wind around a drum placed upon the boat. When power is applied to the drum the boat is propelled, and the cable falls again to the bottom of the canal as fast as it unwinds from the drum.

Many miles of canals, in France, Belgium, Holland, the North German Confederation, Austria, and Russia, are now navigated on this plan.

Under the provisions of the act before alluded to, a company was organized in 1871, called the New York Steam Cable Towing Company; and in November, 1872, the corporation laid down a cable six miles long, in the Erie Canal, extending from Albany to West Troy, and proceeded to make a practical trial of the system. On this portion of the canal there is one lock, and several curves, none of a less radius than 1,000 feet. The cable, an inch in diameter, resembles a submarine telegraph cable. The machinery for working the cable was placed on board the small steam tow boat *Governor Clinton* and connected with the engine. The mechanism is known as Fowler's clip drum. It consists of a cast iron wheel, the circumference of which, forming the groove of a pulley, is provided with a number of movable clips, turning round steel centers. These clips, each pair about two and a half inches long in the direction of the circumference, nearly touch each other, and form thus a complete movable groove, into which a rope may be placed. The centers of the clips are so arranged that the rope, pressed into the groove by its own strain, produces a slight movement of the clips toward the center of the drum, narrowing thus the space in which the rope rests. This will produce a certain pressure of the clips against the rope, which increases with the force with which the rope is pressed into the clips, and which again is in proportion to the strain exerted by the rope. It is, therefore, clear that, with a very small strain in what is called the back or slack rope, a very considerable strain in the pulling or front rope can be exerted without any danger of slipping, as the friction between rope and pulley increases in proportion to the power exerted.

The necessary tension in the back rope is gained by a press pulley, which, rolling on the rope where it leaves the drum, produces sufficient friction between the last clips touched by the rope and the cable itself to replace the required back-strain and secure the action of the clips.

The experience of many years has proved that drums of four to five feet diameter, acting on a rope which touches half the circumference of the groove, are capable of transmitting with perfect safety forty to fifty horse power, the rope moving at the rate of four feet per second, or, in other words, exerting a direct pull of over six thousand pounds.

Into the groove of this drum, which is attached to and worked by machinery on board the vessel, the towing cable is placed. The engine being put in motion, the boat is naturally hauled along the towing cable, which by the action of the machinery is, in a slanting direction, lifted up from the bottom of the canal, and after passing over the clip drum falls back again, slack and nearly perpendicularly into the water.

The weight of the rope, which produces the necessary friction and adhesion to the bottom of the canal, is, if we may say so, the fixed point at which the clip drum pulls. The strain produced by it will be felt some distance ahead of the boat, stretching out that part of the rope. But, after having passed the clip drum, the wire will fall back into the bottom of the canal with the slackness it had before.

The slackness of the rope behind (combined with the fact that ahead of the boat the cable is lifted from the bottom of the canal to a considerable distance), given by the strain, by its weight per foot, and by the depth of the canal, allows an almost perfectly free movement of the boat with regard to steering.

It is alleged that the loss of power by the friction of the cable and winding machinery is only five per cent. We fear that this estimate is too small. The loss of power, from slip of the screw or paddle wheels of ordinary steam vessels, is generally from twenty to thirty-five per cent.

A large number of trials were made with the *Governor Clinton*, including some severe tests in towing heavily loaded barges, all with the most satisfactory results. A number of intelligent engineers, canal officers, and others, who witnessed the experiments, express themselves very strongly in favor of this plan of propulsion on account of its economy and reliability.

The company states that this system will enable boats to make twice the usual number of trips in a season. This will double their earnings, and practically double the equipments and capacity of the canals, and reduce the cost of transportation.

Hitherto no process has been invented for towing boats on canals so cheaply as animal power. For a series of years past animal towage has cost from thirty-five to fifty cents per boat per mile. During the season of 1871, the price has ruled from thirty-five to forty cents per mile. Therefore, the aggregate cost of towing a boat the whole length of the Erie canal, 350 miles, at, say, thirty-five cents, is $122.50.

By the steam cable system, it is confidently believed that boats can be towed through the canal, with double the speed, at a greatly reduced cost. For example: One tug will haul six canal boats at a uniform speed of three miles per hour.

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The cost of running the tugs for twenty-four hours may be stated as follows:

Two tuns coal at	$6	.....	$12
One captain	3	.....	3
Two engineers	3	.....	6
Two wheelsmen	2	.....	4
Two deckhands	1.50	.....	3
Board of 7 men	1	.....	7
Oil, incidentals, etc.		.....	5
			$40

Then, if six days be allowed for making a trip, the cost of towing six boats through the Erie canal, by this system, will be only $240, against $122.50 for one boat by animal towage.

Of course, interest on capital, wear and tear of machinery, and unforeseen contingencies, will increase the cost of steam cable towage considerably above these figures.

The cost of equipping the Erie canal for this system will be as follows:

350 miles double cable = 700 miles steel wire cable	$1,400,000
100 tugs, with machinery complete.....	1,000,000
Cost of preparing locks, gates, and laying cable..	25,000
	$2,425,000
Contingencies, say,.....	75,000
Total.....	$2,500,000

State Engineer Richmond, in his report to the Legislature in 1871, estimates the cost of the construction and equipment of the canals at $80,710,832. In addition to this large outlay of money by the State, individual capital has stocked these canals with nearly 7,000 boats of sufficient capacity to carry, with the present method of towage, over 10,000,000 tuns in a single season. The commerce of these canals has, for the last ten years, averaged nearly 6,000,000 tuns per annum. By virtue of its charter and certificate of organization, this cable company has the exclusive right to tow or propel boats by this system upon the canals for fifty years.

Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible, and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of yonr improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the nventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

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Mrs. C. D. Goodman, Cleveland, Ohio, has used her Wheeler & Wilson Machine 4½ years with the same No. 2 needle that came in it without breaking or blunting it.

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Governor Merrill on the Marion Watches.

Messrs. GILES BROS. & Co., Chicago, Ill.:

I take pleasure in saying that the watch I bought of you, being 21,767, "Fayette Stratton, Marion, New Jersey," made by the United States Watch Co. (Giles, Wales & Co.), has given perfect satisfaction; its variation from mean time since regulated being scarcely perceptible.—SAM'L MERRILL, Gov. of Iowa.

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Business and Personal.

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Wendell's Patent Door Stop, illustrated Dec. 23d, 1871. The best thing for Agents. State and County rights for sale. Samples post paid 40c. Wendell Francis, 436 Walnut Street, Philadelphia, Pa.

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Owners of patents for articles in general hardware trade can sell, or have made and introduced on royalty to advantage by Van Wagoner and Williams, 27 Park Row, New York.

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A competent mechanic wishes to take charge of machinery in a manufacturing concern—well versed in demonstrating machinery. Reference given. Address G. P., care A. Frank, Erie-Basin Dock, South Brooklyn, N. Y.

Adrian H. Muller, P. R. Wilkins & Co., will offer at Auction, on Tuesday, May 7th, at 12 M., at Exchange Sales Room, 111 Broadway, New York, Fireproof Factory in South Brooklyn, L. I. For particulars, address P. O. Box 129, Jersey City, N. J.

Nickel in Solution, fit for plating by applying the same with a brush, for sale by W. F. Wuterich & Co., Harlem R. R. Depot, White St., New York. Invention for sale.

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Important.—Scale in Steam Boilers—We will Remove and prevent Scale in any Steam Boiler or make no charge. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

For Sale—Twenty and thirty horse power Portable Engine of superior quality. Poole & Hunt, Baltimore.

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For the best and cheapest Water Wheel Regulator "in all creation," address Sullivan Machine Co., Claremont, N. H.

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All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

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Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—SULPHATE OF MERCURY.—Will some person inform me how to prepare the sulphate of mercury used in electric batteries?—F. G. V.

2.—DYEING.—Can some of your readers inform me how I can dye an article a cedar color without boiling?—A. C. R.

3.—PHOSPHATE OF CHALK.—What are the proportions of amorphous phosphorus and chalk in the phosphate of chalk, used in the Holmes' signal mentioned in your paper of April 13, page 243?—A. H. C.

4.—AEOLIAN LYRE.—I have tried to find out how to make an æolian lyre, but the one I have made gives no sound. Will some one please give the true construction?—J. F.

5.—WILD BEES.—Will some one inform me which are the best ingredients for baiting wild honey bees, in order to course them to their homes?—C. J. M.

6.—SODA WATER.—Will some one inform me how to make a soda or mineral water generator, or fountain, and the material or ingredients for the mineral waters?—T. E.

7.—GALVANIZED IRON VESSELS FOR MILK.—Will a vessel made of iron and galvanized bright be suitable to hold milk or cream till it sours or clabbers ready for churning? Will it impart any poisonous properties to the milk? And will the milk affect the galvanized metal on the vessel?—W. P. T.

8.—PARCHMENT.—Will some of your readers please inform me how the skins that form the heads of banjos, tambourines, etc., are made so transparent? Can the skin of a cat be made so?—F. W.

9.—MAGNETIZATION.—Is it possible to magnetize a circular piece of steel about six inches in diameter by half an inch thick? How can I apply loadstone to steel? Must the steel be tempered?—M.

10.—DIMENSIONS OF WOODEN AXLES.—Will some one give me a practical and reliable rule for cutting ordinary wooden and thimble skein axles for wagons, so that the wheels will track five feet from center to center? The size of boxes, weight of wheels, dish and length of hub are known.—E. T. C.

11.—GALVANIZED IRON PIPES.—I have through my house galvanized iron pipes, with occasional lead connections and brass fittings. What will prevent zinc poisoning? What is the antidote for zinc? Keeping the water constantly fresh will lessen the evil. I wish its prevention. My tank is galvanized iron.—B.

12.—BRITTLE SPIRAL SPRING.—Can any one tell me why a tempered spiral spring of a pegging machine breaks after it has been run some time? Does the continual pounding condense the steel and make it harder, or does it change the grain of the steel and make it coarse and brittle? Is the steel harder or softer than at first?—W. A. S.

13.—CONCRETE WALLS.—A number of concrete buildings have been put up in this city within a few years past, and but one difficulty is experienced. That is the flaking or scaling off of the outside of the walls, at or near the surface of the earth, caused by the action of the frost on the water which has been absorbed by the wall. What is wanted is a coating, for the outside of the wall, that is impervious to water or moisture. If the difficulty can be remedied a concrete wall would no doubt be superior to any wall yet known for economy and warmth. Who among your many readers can suggest the remedy?—T. D. D.

14.—GREASING COGS.—Is it any use to grease the teeth of geared wheels, as, for instance, the gearing of reaping and mowing machines?—C. A. A.

15.—CRUDE PETROLEUM.—Can this substance be used as a paint? Is it a good preservative of wood work exposed to weather? And will it preserve polished iron or steel from rust?—C. A. A.

16.—ARTIFICIAL CORAL.—Will some one describe the way to make imitation or artificial coral?—W. S. P.

17.—BLACK BOARD.—What is the best preparation for black boards? I have tried several paints and other solutions without success. Is there any preparation whereby a liquid slating may be applied?—F. D. W.

18.—DIMENSIONS OF ENGINE.—I have an engine, the cylinder of which is 6 x 12, the boiler 14 x 32. I ordered an engine of 12 horse power, and received one as above described. Will some of you readers inform me what power the engine can safely develope?—W. A. M.

19.—CLEANING INSTRUMENTS.—Will some one please inform me what is the best material or polish for cleaning surveyors' instruments and the like?—H. O. M.

20.—PREVENTION OF RUST.—What will prevent cast iron stoves from rusting in the salt moist air of the West India islands?—H. C.

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21.—PREPARING FABRICS FOR PAINT.—Will some one please inform me how to prepare white cotton cloth so that the oil from paint will not spread and leave a yellow streak around the paint? Some preparation that will not color the cloth, or render it hard and stiff, is desirable. —F. O. L.

22.—BLOWING OUT BOILER.—Having some doubts as to the propriety of our plan of blowing out, I was much interested in D. & N.'s query (21, March 9) hoping it would draw forth satisfactory information. The advice by S. F., of Pa., (April 6) is in my opinion very good; but it is so different from the general course that I am afraid there is prevalent a great error—and one that does not confine itself to this country—or else S. F. is over cautious. We work two boilers at 70 pounds to the square inch; they might be termed twin boilers, being equal in dimensions and style of build, return flues, etc. They are swung in the ordinary way, divided by midfeather or wall of brick. When the machinery is partially stopped for cleaning, etc., we can run very well with one boiler, the steam being at 55 or 60. We draw the fire from underneath one boiler, and leave open the furnace door, closing the damper and opening the lid in front of the flues. We shut off the connections with the other boiler and open the discharge. In 30 minutes the water is gone. We then open safety valve, close the discharge, open the supply, and commence pumping. In 30 or 40 minutes more our boiler is charged with fresh water, our steam all the time up at from 50 to 60. If this is wrong, will our friends set us right by showing how we ought to act, as I know from observation that many others act in a manner very similar to our own?—J. W. K.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal.

ALL reference to back numbers must be by volume and page.

S. W. S., of Mass., will find the desired information on page 9, Vol. XXIV. of the SCIENTIFIC AMERICAN.

R. T., of N. Y.—Butter is contained in little oil cells which float in the milk. In churning, the envelopes of these cells are burst, and the particles of oil coming together cohere in gradually increasing masses; this is called "gathering."

J. R. E., of N. Y., writes us that no wells are dug in his neighborhood without using a forked limb of plum wood as a divining rod to tell where water may be found. We believe that forked limbs of every kind of timber have been used by the ignorant and superstitious, in search of water or hidden treasure. The ones who pretend to have the power to use these rods for such purposes are forked limbs of—that is, they are humbugs, either self deceived or wilfully deceiving. A man taking a pinch of snuff and digging on the spot where he first begins to sneeze will find water as many times as he will by the fancied indications of forked rods of plum, elder, birch, witch hazel, or any other wood where these varieties do not grow.

MEASURING GASES.—The temperature and pressure are always to be referred to a standard in measuring gases. In metering illuminating gas, temperature is not made standard, as it will average about the same under ordinary circumstances from year to year. The standards of pressure are generally fixed in the charters of gaslight companies, and if they deliver gas at lower pressures they violate their legal obligations to consumers.

F. A. K.—Shall be happy to receive your communication, and will consider it upon its merits.

M. B. C., of Canada.—You need and should get the advice of a practical engineer.

LUBRICATOR FOR STEAM ENGINE.—The best lubricator for a steam engine I ever found was beef tallow and beeswax.—T. W. K., of Texas.

COLORING CASTOR OIL.—To S. W. O., query 1, page 249.—Make a strong tincture of turmeric root with strong alcohol, and add a few drops to the oil until you have the desired color. Rather than being a disadvantage, it will prove a benefit, tending to prevent griping.—E. H. H., of Mass.

NICKEL PLATING LEAD PIPE.—To B., query 9, page 249.—Lead pipe so coated will undoubtedly be good, and the water will be preserved from contamination with the lead, as occurs with all soft water. But, as a matter of economy, no advantage would be gained over the tin lined lead pipe.—E. H. H., of Mass.

DYEING.—S. W. O., query 5, page 249, does not state the particular fiber of which his goods, requiring to be dyed, are made. Wool, cotton, and silk, each requires a change in treatment.—E. H. H., of Mass.

DURABLE WHITEWASH.—Query 3, page 265.—Salt or glue size renders whitewash durable.—B.

LAMP CEMENT.—Query 7, page 265.—A high heat will calcine and thus soften the gypsum used to fasten lamp collars.—B.

DOMESTIC EMPLOYMENT.—Query 10, page 265.—Home employment for every working member of a family can be afforded by caning chair seats, making brushes, brooms, baskets, rag carpets, ink, dyes, flavoring extracts, yeast cakes, salves, or a hundred other articles. Don't forget the children's education.—B.

QUESTION IN OPTICS.—Query 12, March 23, 1872.—The magnifying power of a refracting telescope depends upon the relative focal distances of the object glass and eye glass, the exact magnifying power in diameter being found by dividing the focal length of the object glass by that of the eye glass. The illuminating power, or the power which makes objects appear brighter and enables us to see stars which are invisible to the unaided eye, depends upon the diameter and purity of the object glass employed, or, in other words, upon the increased amount of light which is conveyed to the eye by the object glass of the instrument. In the microscope the amplification is found by multiplying the magnifying power of the object glass by that of the eye glass.—J. B.

DOEBEREINER'S LAMP.—To L. G. G.—Take an ordinary fruit jar, with a cork stopper or leaden cover; procure any old bottle that will go into the jar, at least two thirds as tall as the jar. Cut off the bottom of the bottle either with a file, or by wrapping a piece of candle wick soaked in alcohol around it, burning the wick, and dipping in water while hot. A hole is cut in the cork or lead cover to admit the neck of the bottle and prevent it resting on the bottom of the jar. The bottle is closed with a cork fitted with a short glass tube bent at right angles and drawn to a fine opening. Some pieces of zinc are suspended in the bottom by a wire or little basket of lead. The jar is then filled to about one half with dilute sulphuric acid. The acid, coming in contact with the zinc, generates hydrogen gas which escapes from the glass tube. The mixture of air and gas being highly explosive, the lamp should not be ignited at first. After all the air has escaped, a piece of spongy platinum may be placed a little distance from the point of the tube. The gas, impinging on the platinum, heats it sufficiently to ignite itself. The escape of gas may be cut off by slipping a rubber tube closed at one end over the glass tube, or a tube with a stop cock may be used. As soon as the escape of gas is cut off, its pressure drives the acid out of the bottle into the jar, and no more gas is generated. Pieces of spongy platinum mounted on wires suitable for this use may be obtained of dealers in apparatus for thirty-five cents each, and can be sent in a letter.—J. S., of N. Y.

BLOWING OUT STEAM BOILERS.—D. and N., query 21, page 169, are informed that steam boilers should never be blown out under steam pressure. The safety valve should first be raised until the pressure is all removed by letting the steam escape as rapidly as possible; then the hand hole plate or other device should be opened, and the dirt and sediment will run out with the water. But if the boiler is allowed to cool off, the dirt will settle to the bottom and be fastened on by the heat. The dirt is always on the top of the water when there is any pressure of steam on it. I have practiced the above method for ten years, and have had no trouble whatever with scale, although the water was very hard.—J. C., of O.

CLEANSING BOILERS.—Hot water will do no harm to D. and N.'s boiler.—J. C., of O.

COPAL VARNISH.—Good varnish is difficult to get; one trick of the trade is to use but little gum, and putting, into the linseed oil, white vitriol and sugar of lead, rendering the oil nearly thick enough for varnish before any gum is added. Another cheat is to make cheap, sticky, worthless stuff by using raw oil without dryers; because, forsooth, if a black, stiff, worthless article dries quickly (and cracks and scales quickly also), a light colored, limpid, slow drying article must be good. Twenty years ago we mechanics up here in Vermont made our own varnish and japan; it was the only way by which we could get anything reliable. In the meantime, Mr. Abbott, of New Hampshire, got Moses Bigelow to go up to Concord and make varnish for the carriage shops, and then we commenced buying of Mr. Abbott. Since that time, we have had dealings with all the manufacturers in Boston, New York, and Newark, and, until the recent war, generally got good varnish; but during the war, adulteration found its way into every manufactory, and even to-day a good article of varnish is, perhaps, stored in one cask out of a hundred, and there are two ways to get it. One is to make it, and the other is to eschew dealers and speculators; buy of the maker, pay just what he asks, and, if your custom is worth anything, you will get a good article. Otherwise—doubtful. The best copal varnish is made as follows: Take three pounds of the best Zanzibar copal gum to every gallon required, pulverize the gum in an iron mortar, and then put it into a copper pot which will hold double the quantity required; fit a cover to the pot with a small hole in the cover, through which to insert an iron rod to stir the gum when melting; heat over a slow fire until thoroughly melted, stirring it constantly during the process. In the meantime, put into another pot and over another fire 1½ pints of raw linseed oil to every pound of gum in the first pot, and add to the oil sufficient dryers to make a medium drying oil, boiling as usual for ordinary purposes, keeping it hot until the gum is thoroughly melted. Then remove from the fire to a distance of twenty or thirty feet, pour the oil in gradually, stirring at the same time; and, while still hot, add sufficient turpentine to reduce the gum to a proper consistency, which can be tested by dropping a little from the end of the rod on to a piece of glass to cool in the air. The gas arising from a hot pot of varnish is very inflammable; and if the steam, by floating around, reaches the fire, it will flash as quick as gunpowder, and the face and hands of the workman will be burned and the varnish set on fire; therefore remove to a distance before adding the turpentine; also have a wet cloth ready to throw over the fire in case of accident. When all is well mixed, strain, while quite hot, through a funnel partly filled with clean flax, through which not a speck of unmelted gum, dirt, or settlings will pass. If flowing varnish is required, add a trifle more oil, with no dryers except a little red lead. If hard or scraping varnish is required, use but half a pint of oil to each pound of gum, and boil hard with plenty of dryers.—C. T., of Vt.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

BOILER EXPLOSION.—C. E. G.—G. J. E.
BROADWAY TRAFFIC.—G. E. N.
CANAL BOATS.—J. M. E.
CHLORO-ACETIC ACID.— —.
DOOR FASTENER.—J. M. P.
ENDORSING ENVELOPE.—X. P. M.
PROPULSION OF CANAL BOATS.—J. N. P.
ROTARY ENGINES.—J. A. H.
TUBAL CAIN.—W. B.
VENTILATION.—C. G. V. P.
ANSWERS TO CORRESPONDENTS.—S.—X.—C., S., & Co.—J. B.—H. S. M.—T. W. K.
QUERIES.—S. A. E.—J. G. X.—L. S. F.—O. F. H.—H. N. M.—R. A. R.—W. N. B.—F. K.—J. H. W.—C. C. B.—V. P.—E. H. F.—C. O. D.—L. S. B.—H. B. H.—G. L. H.—T. K. McI.—J. B.—W. B. W.—J. H., Jr.—S. D. W.

NEW BOOKS AND PUBLICATIONS.

THE LAND OF DESOLATION: Being a Personal Narrative of Observation and Adventure in Greenland. By Isaac L. Hayes, M.D. New York: Harper & Brothers.

Dr. Hayes is well known as an arctic explorer. In 1869, he formed one of a party who accompanied the artist, William Bradford, to the icy regions of the North, and in this volume the author gives us many particulars about Greenland. Five hundred years ago this arctic continent, now so desolate, was the home of a large and enterprising population. They had churches, cathedrals, and the principal institutions of advanced civilization. From Greenland came the Northmen, who discovered this country and began settlements on the coast of Massachusetts, A.D. 1000—almost five hundred years before the discoveries of Columbus. But through the combined agencies of pestilence, the invasions of savage tribes from America, and finally, about A.D. 1500, by the attacks of the English, the settlements were destroyed. The present inhabitants, Christianized natives, few in number, are under Danish rule, and are employed in fishing and seal hunting. It is believed that the climate is now more rigorous than formerly. The interior of the country, as far as it has been penetrated, is covered with solid ice, thousands of feet in thickness, which finds its way to the sea through the valleys in the form of glaciers. One of these, the Humboldt glacier, is 60 miles wide and 2000 feet thick. The glaciers break into pieces on reaching the sea, forming icebergs, which float southward as far as Newfoundland. Dr. Hayes's book is full of useful and interesting information.

FARM GARDENING AND SEED SOWING. By Francis Brill.

This is another of the useful agricultural books from the publishing house of Orange Judd & Co., New York. This little book is devoted to farm gardening, by a practical market gardener, and contains full directions for raising vegetables of every variety, indicating the soil best adapted for each—best mode of propagating, storing, packing for market, and other matters of a practical sort pertaining to the management of a garden.

HINTS TO PERSONS ABOUT BUILDING IN THE COUNTRY. By A. J. Downing, Author of "Landscape Gardening, etc." And "Hints to Young Architects, Calculated to Facilitate their Practical Operations." By Geo. Wightwick, Architect, Author of the "Palace of Architecture," etc., with additional Notes by A. J. Downing. Third American Edition. New York: John Wiley & Son, 15 Astor Place.

These are two works in one volume, the price of which is $2. The book is neatly printed and bound in cloth. The authors are well known to the public through their hitherto published works, and it is scarcely necessary to say that the present volume is likely to prove in the present, as in former ditions, a valuable addition to the literature of architecture.

Recent American and Foreign Patents.

nder this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

WINDOW SHADE.—Elliott Metcalf, of Taberg, N. Y. and Charles Allen of Woodstock, Canada.—This invention relates to venetian shades for windows. The shade consists of slats, which may be made of wood, metal, or other suitable material, connected together so as to lap onto each other, by means of a cord or cords, or by tapes or webs. This shade is opened, either in whole or in parts, by two cords, one of which is attached to the edge of the lower slat of the shade, and the other to the middle shade, or about the middle as may be desired. By pulling one of these cords the lower half of the shade will be opened while the upper half will remain closed. By pulling the other cord, the upper half will be opened while the lower half may be kept closed. These cords pass through holes in the lower edges of the slats, and are knotted, so as to raise the slats when their other ends are pulled down, as before stated. The cords pass over a pulley or through a screw eye at the upper corners from which point they are carried horizontally to the center confined by screw eyes, whence they drop down and are attached to the slats. On the other side of the window two cords are arranged, by means of which the shade is raised when both cords are pulled down. When one cord only is pulled down the shade is raised on one side only and thrown into the form of a fan or quarter circle. The shade may be attached to a rod, which is fastened to the casing of the window, or attached directly to the casing.

THILL COUPLING.—Edward S. Roberts, of East Canaan, Conn.—This invention is an improved thill coupling, claimed to be simple, strong, durable and reliable, and which will allow the thills to be readily attached and detached when desired. It consists in the thill coupling constructed so that by raising the thills into a vertical position, to turn certain flanges out of their respective rabbets, the thills may be moved laterally, uncoupling the coupling and detaching the thills. A rubber block prevents rattling and the thills cannot become detached while in the working position.

SASH HOLDER.—George H. Johnson and Frederick Bottner, of Bridgeport, Conn.—This invention consists in a novel arrangement of a pivoted flexible pawl for supporting carriage and other window sashes, as hereinafter described. This fastener is particularly adapted to the doors and sashes of landaus, the sash being required to extend far up above the door, and be held so as to close the space between the two parts of the carriage top when the latter is closed; but it is useful also for holding the sashes of houses, etc. A flexible pawl and cord are combined with the sash; and a combination with a spring and an attaching plate, with some other arrangement, are used, which together make this an undoubtedly useful, as it is a somewhat unique, invention.

VELOCIPEDE.—Solon A. Gregg, of Oneida, N. Y.—This invention has for its object to furnish an improved velocipede wagon, so constructed as to adapt it for use upon common roads. The machine may be made with one or two forward wheels, and is designed to be made of such a size and strength that a pair of shafts may be attached to it when desired to use it with horse power. A combination of a hand bar, rod, lever, pitman, foot rests and crank with each other and with the frame and axle of the velocipede, gear wheels, and shaft: also a combination of a rod with the swiveled axle, hand bar, rod, lever, pitman, foot rests, crank, and axle: also, a combination of a spring with the pitman, foot rests, crank, axle, lever, rod and hand bar constitute the claims on which a patent has been issued.

SEATS FOR VEHICLES.—John R. Linton, of New Bedford, Mass.—This invention has for its object to furnish an improved riser or base for the seats of vehicles, which shall be so constructed as to obtain the requisite strength and lightness combined with such a size as not to be out of proportion with the other parts of the vehicle. And it consists in a riser or base formed by the combination of a metallic brace or plate with a wooden frame of the riser or base, the bottom bar of which rests upon the rail or edge of the wagon box, and to the top bar of which the seat is attached. A brace, or plate made of wrought or cast metal, is attached to the wooden frame by screws, bolts or rivets. The brace or plate may be placed within the frame or upon its outer side, as may be desired, and may be made of any desired pattern or style and ornamented to any desired extent.

MEDICAL COMPOUND FOR HOGS.—John Shannon, of Palmyra, Mo.—This invention consists in a compound formed of sulphur, copperas, alum, saltpeter, resin, fenugreek, antimony, assafœtida, soot, and salt. The peculiar diseases or ailments of the animal for which it is intended are not stated in the specification.

DENTAL PLUGGER.—White F. Griswold, of Leavenworth, Kan.—This invention consists of a plugging instrument in which the sliding mallet, with a spring for impelling it against the tool stock, is inclosed in a tubular stock and is provided with several studs projecting through slots in the stock at equal points of distance around it, to be used for forcing the mallet back against the springs, and so that the instrument may be rotated, as is often required while at work, and yet always have a stud at command for retracting the mallet. The invention also consists of notches in the end of the tube, out of which the tool stock projects, and pins in the latter, falling into said notches when the tool stock is retracted by its spring, and serving to hold the tool against turning on its axis while at work: also, to hold it for attaching and detaching the tools from the stock to change them, said tools screwing in and out of the stock, and thus saving the necessity of holding such stocks from turning in the tube holder by one hand while screwing the tools in and out by the other. In taking out and putting in tools by one hand, which is sometimes highly necessary, the stock is held against the palm of the hand by the third and fourth fingers and the tool actuated by the thumb and first finger. The stem of the mallet may be extended through the case or not, at will, and the tool may have a hole through it to introduce a lever for screwing it in or out.

SAW SET.—Hiram R. Lavey, of Bristol, Wis.—This invention relates to a new arrangement of rest, gage, guide, and punch in a saw set; and has for its object to so construct and combine these devices as to reduce the size and cost of the complete instrument to a minimum, and enable the punch holder and guide to be secured and adjusted by the same screw in order to facilitate the practical operation of the instrument. The slotted gage or guide and the punch holder provided with the horizontal slotted base, arranged in a peculiar way, and secured to a base, having ribs, by means of a screw, constitute the claim on which a patent has issued.

COMBINED SHOVEL AND TONGS.—Thomas G. Newnam, of Pleasant Hill, Mo.—This invention is an implement for handling live or other coals, brands of fire, and other articles, designed to be used as a substitute for the separate shovel and tongs in common use. It consists in a shovel blade on a slotted handle, and in a wire brush or rake on the end of a handle, which works in the slot of the shovel handle. The shovel handle is bent so as to form two arcs of circles, with a ring handle at the end to take hold of. A brush or fine rake is on the end of a third handle. This handle passes through the slot in the shovel handle, where it is allowed to play longitudinally and up and down, according to the purpose for which the implement is to be used. A shoulder limits the distance which this handle extends through the slot. The shovel can be used to take up ashes, etc., and coals can be raked onto the shovel by a longitudinal movement of the rake handle, and a brand of fire, stick of wood, or other article can be griped between the parts and handled as with a pair of tongs.

CASTING PIPE.—Charles J. Ellis, Louisville, Ky.—The invention consists in improving the usual means for casting pipe, by constructing the stools which support the flasks in arc sections, and thereby rendering them adjustable by the simple addition or subtraction of one or more sections.

CLEANING LAMP CHIMNEYS.—Henry W. Prouty, Boston, Mass.—In this case, a suitable handle is provided with rubber or other elastic disks or washers, so applied and adjusted as to admit of the use of a cloth or other material for cleaning chimneys with ease and rapidity.

BERRY BOX.—Charles Reese, Baltimore, Md.—The invention consists in improving the construction of paper fruit boxes by fastening the previously slitted and folded sides with tin clamps. This method of construction involves so little expense on the articles as to make the cost inappreciable and to allow them to be given away with the fruit, while at the same time they are sufficiently strong for handling and transportation,

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ROTARY STEAM ENGINE.—William Darker, of Philadelphia, Pa., assignor to himself and Josiah D. Thompson, of same place.—A hollow cylindrical stationary case of cast metal has a tubular projection projecting from each side of the side plate, at the center, for the support of the shaft, which at the outer end carries the driving pulley, and at the inner end a hub and radial arms, on each of which is mounted a tread wheel which, in conjunction with flexible devices, confined steam tight between the sides of the case and vibrating between the inside of the periphery and the annular ribs of the case, constitute the means of impelling the shaft around on its axis by steam admitted at the ports between the flexible devices and the periphery of the case, and escaping into a space inclosed by the concave side, covering a large central opening through the side of the case, from which space it escape sthrough an exhaust pipe. The flexible devices are composed of short metal bars backed with flexible vulcanized india rubber packing, or any equivalent, the said bars being arranged transversely of the strips on the inside, and the strips extending around the case, with the periphery nearly half way, and being fastened at one end, just in advance of the steam ports, by clamping pieces and bolts. The said plates have pins passing through the inner strips of india rubber, to keep them in place. The inner strips are of pure rubber, and fit snug and steam tight against the polished sides of the channel, and the outer strip is composed of rubber and canvas, to prevent too much elasticity, and fits loosely. These flexible devices are depressed against the periphery of the case, steam tight, in advance of the steam, which, forcing them behind the wheels, impels them forward and causes them to revolve on their own axes. The movement of these flexible devices is very slight, being only about a quarter of an inch, which, it is believed, will not injuriously affect the rubber, the integrity of which is preserved by the moisture of both the exhaust and the live steam, the former being diffused throughout the whole interior space of the engine. Idle ports are applied for running the engine in the opposite direction, which may be done, if desired, by reversing the flexible devices. For the purpose of lubricating the axles of the wheels, water is used, to avoid the use of oil or tallow which are injurious to rubber. Peculiar devices are employed for this purpose.

COMBINATION LOCK.—John Moffet, of New York city.—In this improved lock a disk with a wide edge, having six (more or less) large grooves across said edge at equal distances apart, and with a deep and narrow circumferential groove between the transverse grooves, all in different planes, is mounted on a spindle which carries the bolt operating wheel, and as many blocks are provided in corresponding transverse grooves in a case surrounding the disk as the number of transverse grooves in the latter, with an adjusting screw for each block, which has also a tongue projecting into a transverse groove of the disk, all of which tongues must be adjusted by the screws to the circumferential grooves before the bolt can be thrown, and these adjustments are made according to a record kept, showing how many turns each screw must make to bring the tongue of its block to the right position. The screws, which are confined within the case, have each a toothed wheel with which a wheel on an arm revolving around the axis of the knob spindle is brought in contact for effecting the necessary adjustments, by turning a sleeve on the said spindle. The arrangement is such that even a quarter turn of one of the screws out of the true position will prevent the opening of the lock. As many changes can be made made as there are transverse notches and shifting tongues, and with each change a different combination table of revolutions for the turning of the screws is required. The construction is such that a perfectly tight packing is maintained around the spindle, so that the introduction of powder or other explosive material is prevented. A novel arrangement of a tappet wheel is introduced for throwing the bolt, which is adapted to throw the bolt with the spindle set in any one of the six positions to which it may be adjusted in making the changes.

EAVES TROUGH SUPPORTER.—Benjamin Prugh and Henry Austry, of Grant City, MO.—This invention relates to a mode of putting eaves troughs together, and supporting them beneath the eaves of the building. The invention consists in the mode of connecting the tube, trough, and clamp, nd in the construction of the leader clamp. This clamp is made in two parts. The lower part supports the trough and covers the joints where the lengths of the trough are put together. The upper part extends across the trough, being connected with the lower part, at its outer end, by a screw and nut. The other end is bent over the inner edge of the trough and brought in contact with the inner end of the lower part, where the two ends are secured together and to the building by an angular bolt. The upper portion of the clamp prevents the trough from spreading; and by turning down the nut the two lengths of trough are firmly clamped together, and the joint is made tight without the use of solder or rivets. This is a great advantage in putting up tin troughs, as the sheets of tin may be soldered in short lengths, and put up very easily with these clamps. Where other means are employed for attaching the trough to the building, the clamp is constructed with shoulders on the under side of the upper part, which bear against the inner edges of the trough. A clasp, the ends of which are bent over the edges of the trough and secured thereto by lips, has shoulders which bear against the inner edges. These clasps are used between the clamps to prevent the trough from spreading. The conducting tube is attached to the trough and to the clamp. The leader is secured to the tube by a screw clamp, and to the side of the building by a screw or nail.

BEE HIVE.—Cyrus C. Aldrich, of Morristown, Minn.—This form of hive is claimed to be adapted to the habits of honey bees. In their natural state they cluster together in a globular form and lay their brood in this form; and in the cylinder the honey is nearer the brood than it is in a square hive. By this mode of construction the hive may be opened and access had to the surplus honey, while the brood chamber is entirely closed and the heat retained. By sliding shutters and an adjustable ventilating tube, the heat or temperature of the hive is readily controlled both in winter and summer. The claims are as follows: A combination of a bottom apertured cylinder, having longitudinal slat at the top, with a perforated tube let into said slat, and the separate ring frames arranged to provide a circulation of air. A two part cylinder having an upper notched and a lower unnotched slat combined, with notched partition plates, so that said partitions shall be prevented from turning or laterally sagging. Frames, each provided with hooks diametrically opposite and reversed, in combination with a two part cylinder having projecting plates, so that said frames cannot sag laterally or turn. A combination with a two part cylindrical hive, of jointed bars, arranged between the said two parts, so that they can be drawn out first to break the bee cement and to allow the hive to be easily opened.

HOISTING APPARATUS.—James D. Warner, of Brooklyn, N. Y.—An endless chain is arranged to run on pulleys alongside the spring piece on a pier. At the land end it is led under the roadway or under a cover of any suitable kind. An engine operates a windlass, around which the chain is wound, so as to give it the required "bite." The end of the hoisting rope s attached wherever needed by hooking on a clutch. As soon as the required hoisting or drawing is done, the clutch can be unhooked by pressing a handle in toward the chain. Whenever there are goods being continually hoisted or drawn a certain required distance, the clutch may be unhooked automatically by passing against a trip. In order to prevent the goods running down before needed, when the clutch is unloosed the rope will jam, by an eccentric button (as soon as the action begins to retrograde), against the side of the narrow passage of a brake, or projection. This is released as required by pressing in a handle, or used to prevent the merchandise from being lowered too rapidly. Hoisting may be done at several different places around the pier at the same time, whereby steam power may be substituted, for the horse or hand power now used, to great advantage.

APPARATUS FOR LEVELING MILLSTONES.—Benjamin H. Meitzler and Philip L. Hoos, of Fort Seneca, Ohio.—The object of this invention is to provide efficient and convenient means for leveling the grinding surfaces or faces of burr millstones. It consists in the mode of supporting, adjusting, and leveling the "staff" upon the stone. The bed plate of the apparatus is fitted to the neck of the spindle. It is a round disk provided with set screws for adjusting the staff on the face of the stone. Curved stanchions, four, more or less, in number), have their upper ends attached to and support a vertical cylindrical block upon which an inverted cup is fitted, provided with an adjusting thumb screw by which the cup is raised or lowered on the block. The staff is connected with the cup by a curved bar. his bar extends out horizontally on top of the staff, and is fastened thereto by thumb screws. In the center of the staff, and visible through a suitable aperture in the bar, is a spirit level, by which the face of the staff is leveled. The staff, being connected with the inverted cup (which cup is allowed to turn or revolve on the top of the block), may be moved around the bed over the grinding face of the stone. The face of the staff is covered with red or other coloring matter, so that wherever it touches it leaves a mark or colors the stone. The highest places or points on the face of the stone are thus ascertained, and the places are indicated where the stone should be picked down to make its surface even and of uniform hight.

BALE TIE.—David L. Miller, of Madison, N. J.—This invention relates to a new tie for cotton, straw, hay, and other bales; and consists in applying a fastening catch, in form of a double hook, to one end of the band or strap that embraces the bale, and in providing loops at the end of the said strap for the reception of the hook, by which arrangement the band can be quickly and securely closed around the bale. The hook is connected with the strap and, therefore, not liable to be lost or misplaced, and is always in position for immediate use whenever the strap is placed around the bale. The invention also consists in a peculiar manner of forming the loops at the ends of a wire strap or band by twisting, and in thereby insuring greater strength and durability. The hook firmly unites the ends of the strap, and constitutes a reliable tie for holding the bale compressed.

OYSTER BASKET.—Charles D. Martin, of Port Chester, N. Y.—This invention consists of a basket with woven sides and bottom of flat strips o thin galvanized iron, with wooden hoops for the top, bound with galvanized wire, and with wooden handles, the said iron strips being woven with large meshes to facilitate the washing, and riveted together at the crossings for keeping the vertical and horizontal ribs in their places; and an auxiliary stay rib is woven in at the bends of the verticals for the bottom, where they cannot well traverse each other, in such manner as to retain the bands in shape against the action of the weight, which has a constant tendency to straighten out the said bands. A basket of this kind will be much stronger and more durable than a basket of the ordinary wood splints, and the strips can be riveted at the crossings to keep them from shifting out of place with safety, which will not do with the wooden strips, because it weakens them so.

ELECTROMAGNETIC ENGINE.—William G. Thornton, of Victoria, Texas.—This very novel invention relates to a new practical application of electromagnetism to moving machinery. The invention consists principally in the transmission of electromagnetic power through compressed air for motor purposes, and the mechanism and combination of machinery necessary for that purpose. A lever is pivoted to a fulcrum standard. An air pump, with all necessary valves and fixtures, is worked by the lever to supply an atmospheric receiver. The level is worked by electromagnets, in conjunction with gravitation—the electromagnets to lift the piston and gravitation to drive it down. The distance, at which the first armature and pair of magnets is fixed from the fulcrum of the lever, depends upon the strength of the magnets. The first pair of magnets have little more to do than to lift the piston of the air pump. The next pair of magnets, being of the same power as the first, continue the movement, owing to mechanical advantage in length of lever, and so on, each pair of magnets gaining mechanical power as the distance from the fulcrum increases, thus enabling them to meet the constantly increasing resistance of the air during the whole time of magnetic action. It must be understood that the first pair of magnets—that is, those nearest the fulcrum—will bring down the lever so that the next armature will be brought under the influence of the next pair of magnets. When the first armature, therefore, has reached its magnets, it will remain idle during the continuance of the stroke; and so with each armature, one after the other. They all will become idle and stand upon the magnets until the stroke is finished and the circuit opened. When the circuit is opened, the weight of the piston at the opposite end of the lever, aided, if necessary, by an extra weight or spring, will lift this end of the lever to the starting point, and, as it rises, each armature will be taken up in its turn, and they will all assume their places on the lever ready for another stroke, at which time the circuit is closed by an automatic tender, and the action repeated, and so on. The power stored up in the air receiver is advantageously used to propel an engine.

INVALID BEDSTEAD.—Henry A. Scott, Winchester, N. H.—This invention relates to a new invalid bedstead, whose movable frame is raised and lowered by means of arms projecting from geared cams, to thereby insure even and convenient motion. The pivoted head rest is supported by a spring ratchet, which permits rapid adjustment. The geared cams, carrying the arms, arranged on a bedstead to constitute supports for the adjustable frame, and the pivoted head rest, provided with spring ratchets, and combined with pins and a string, are the parts upon which the claims are based and allowed.

APPARATUS FOR RAISING DOUGH.—Sophronia V. Dodge, De Soto, Iowa.—This is an improvement in apparatus for raising bread, which consists in an outer shell or casing, with a removable false bottom and lamp chamber, and, in combination therewith, a containing vessel and lamp, the whole constructed and arranged so that a very small flame will supply sufficient neat, which will be evenly distributed around the containing vessel. The contents will be uniformly warmed for producing the desired effect. This apparatus is claimed to effect a great saving in time, and to do the work thoroughly and perfectly in the coldest weather. The vessel is provided with a tightly fitting cover, so that a kerosene lamp may be used without any ill effects upon the bread.

MACHINE FOR WELDING EARS ON ELLIPTIC CARRIAGE SPRINGS.—Aaron Richards and Josiah Jones, Concord, N. H.—This invention relates to a new arrangement of foot or power hammer for welding ears to the ends of elliptic carriage springs and equivalent purposes. The invention consists, first, in making the hammer vertically and horizontally adjustable at its pivoted end to make it fit the lower die in the desired manner. The invention also consists in the peculiar arrangement of the die, which is made in three sections, the central one of which, when struck by the hammer, causes lateral motion of the side sections for acting against the sides of the ears.

CARDING MACHINE.—Ephraim French, North Adams, Mass.—The card rollers working in connection with the main cylinder are arranged in the ordinary manner. The doffer is revolved in the usual manner by a belt on the pulley. The fancy is revolved in contact with the surface of both main cylinder and the doffer, by a belt from the main cylinder, and is given a traversing or endwise reciprocating motion, as it revolves, by means of a cam groove on the block of the doffer shaft. One end of a vibrating lever plays in a groove in the "fancy" shaft, and the other end plays in the cam groove of the block on the doffer shaft. As the doffer shaft revolves, the "fancy" is made to traverse back and forth a distance equal to the "throw" of the cam groove. The inventor is not confined to this particular device, as there are many ways by which this traversing motion could be produced. The "fancy," thus traversing in contact with the surfaces of both the main cylinder and the "doffer," keeps the material (wool, etc,,) on the surfaces of those cylinders more even and uniform than when it is run in the ordinary manner, thereby avoiding streaks of the material on the cylinders. In ordinary carding machines, the doffer requires to be cleaned daily, or at least very frequently; and when low or dirty stock is used. the doffer soon becomes coated, so that the stock drops to the floor and becomes waste, thus necessitating cleaning of the doffer several times a day. This of course occasions a stoppage in production, and entails much loss. The inventor claims that, with the reciprocating fancy roller, it is unnecessary to remove the doffer for cleaning it for several weeks at a time, as it is cleaned by the teeth of the fancy during the operation of the machine.

MACHINE FOR CUTTING LEAD.—Charles Koehler, Evansville, Ind., assignor to himself, Charles Babcock, and Edgar Sharpe, of same place.—This is a new machine for cutting blocks of lead into cubic or other four sided prismatic pieces to be used in the manufacture of shot, according to a plan for which letters patent were granted to the same inventor, January 25th, 1870, or on any other plan, or for cutting other material for suitable purpose. The invention consists, first, in the arrangement of rotary cutter heads, carrying three kinds of cutting tools—for ribbing horizontally, cutting vertically, and, finally, chopping or slicing the pieces from the end of a block of lead or equivalent material. The invention also consists in the combination of the above with an automatic feed device for moving the lead ahead whenever a series of cubes have been cut therefrom.

TRUSS.—Edmund P. Banning, Jr., New York city, assignor to the "Banning Truss and Brace Company," of same place.—This is a new arrangement of balls for a truss for the cure of prolapsus ani, and also to improvements in the spring holder of a truss for umbilical hernia, and in the shoulder brace attachment to a spinal support. It consists in a peculiar mode of applying the balls to the adjustable shank of the first named truss, so that the balls may not move on the body, though the truss may be moved; secondly, in providing a slot in the spring holder of the umbilical truss for the self-adjustment of the ball; and, finally, in slotting the upper end of the spinal support to permit the automatic adjustment thereon of the shoulder braces.

THROTTLE VALVE STAND AND STEM.—John M. Compant and Engelbert Krauskopf, of Fredericksburg, Texas.—This invention relates to a new arrangement of support for the stem of a throttle valve, and has for its object to facilitate the lubricating of the screw and cause the parts to be firmly held in place. The invention consists in forming a screw on the outer end of the stem and fitting it into a nut that is, by braces, held to the stand. The valve is attached to the inner end of the stem in the ordinary manner. The outer end of the stem carries a hand wheel. By the outer nut and inner bearing, the stem is securely held at both ends. The screw can be conveniently lubricated, so that it will not grind in the nut, nor wear out in a short time, like the screws of ordinary throttle stems.

CANE GUNS.—Albert Karutz, of Brooklyn, N. Y.—This invention relates to improvements in cane guns; and it consists of a novel arrangement of a cranked lever and catch spring with the needle, whereby the lever is employed both to retract the needle and to trip the catch spring to allow the needle to fire the cartridge. The arrangement of the barrel allows of loading at the breech by disconnecting two sections and putting the cartridge in the end of the forward section, after which they are connected again. A combination of a cranked lever, spring, and needle, arranged in a peculiar manner, constitutes the claim.

SOLID BILGE BOAT.—Daniel Brader, of Beach Haven, Pa.—This invention relates to an improvement in the construction of solid bilge boats to form a gradual slant and cause them to run more easily. Upon the front portion of the keel is placed a triangular piece of wood, called the dead wood, which abuts against the inner side of the timber head. The flooring beams are, with their inner ends, tenoned into the dead wood, so that they gradually ascend from the flat bottom toward the bow. The outer ends of the flooring timbers are secured, by tenons or otherwise, in the bilge logs, which form an angle at a point which is in line with the lower end of the dead wood, and then ascend toward the timber head parallel with the upper face of the dead wood. In this wise the floor of the boat receives a slant or rake of one foot or more at the bow, which eases the boat, making it cut more readily through the water. At the stern there is the same arrangement, excepting the stem, which is omitted. A lap timber is placed upon the bilge logs, where the same form the angle; and an inner lap timber is placed against the angle of the bilge logs.

STOP MOTION FOR MACHINE FOR COVERING CORD.—Reuben Lewis, New York city.—The nature of this invention precludes an intelligible verbal description of its details. We can say, from close examination, that it seems a very ingenious and useful device to effect the purpose intended, and is evidently the work of a practical mind, thoroughly conversant with the requirements of the case.

EARTH SCRAPER.—Michael Kelly, of Fairfield, Vt.—This is an improved earth scraper for grading, road making, etc., enabling more work to be done with less labor to man and team than when an ordinary scraper is used. It is provided with wheels and a seat for the driver, and the scraper proper guided and controlled by suitable mechanism, the claim in the patent covering a combination of uprights, a gate or frame, a scraper, rods, racks, gear wheels, shaft, ratchet wheel, pawl, lever, and lever pawl, with each other and with the axle, wheels and tongue.

SHOVEL PLOW.—George Hopkins Smith, of Des Moines, Iowa.—This is a cast shovel plow for cultivators, so made as to possess the requisite strength while leaving its forward side or surface of the proper form to do the required work. Upon the middle part of the back of the shovel is formed a strong rib, extending down to, or nearly to the point. The upper part of the rib is made wider, and has cavities or recesses formed in it, to receive the bosses or projections of the plow seat, by which the plow is secured to the plow standard. Upon the rear sides of the side edges are found short projections, ribs, or thickenings, extending for such a distance as may be necessary for throwing out a full corner and giving the requisite strength to the shovel, the upper parts of the side edges, where so much strength is not required, being made lighter. The shovels may be cast of any metal that will give a good tough cutting edge and a strong back, and will take the highest possible temper upon the front. Cast steel fronts cast upon Bessemer steel backs, in cast iron molds, are recommended.

RAILROAD CAR VENTILATOR.—Samuel E. Kirkpatrick, of St. Albans, Vt.—This invention consists of an arrangement of passages adapted to promote the inflowing of pure air and escape of heated and foul air through openings similar to the ordinary ones used in the upper parts of the sides of cars and controlled by one valve. It also consists of an arrangement for locking the valve open or shut. The uppermost escape passages for the warm and light air discharge under the roof, which prevents the cinders from falling in through the passages, while the warm air either escapes up through an opening in the roof when the cars are not running, or downward through other openings when they are running, by reason of the down draught caused by the motion. Lower passages for the inflowing air, allow it to enter free from the cinders,

PROPELLING CANAL BOATS.—Wilson P. More, of Moresville, N. Y.—An endless chain passes lengthwise around the middle of the boat (or nearly so.) Grooved driving wheels, on pulleys, are rotated by suitable power applied on the boat. Pivoted chain guides are placed respectively at each end of boat, and movable laterally on rods, so as to serve the purpose both of rudder and guide. A trough is arranged on deck, beneath the chain, receiving the drip therefrom. This trough is constructed on a decline from the middle toward each end, so as to transfer the drippings and discharge them at any desirable point. The chain is made heavy, to give tractional power; and loose, so as to bring as large a portion as possible of its surface in frictional contact with the bottom of the canal. It may or may not be provided with spikes or points, they being auxiliary but not necessary to the principle of operation. The chain is composed of heavy main links and intermediate open connecting links, so that, on levels, larger or smaller portions of the chain may be readily removed, and reinserted when on grades of more or less acclivity or declivity. The claim allowed covers a combination, with the movable endless drive chain of a canal boat, of pivoted and laterally vibratory chain guides, arranged, respectively, at bow and stern, as set forth, for the purpose both of guiding and steering as described.

HOSE NOZZLE.—George O. Wickers, of Lawrence, Mass., assignor to himself and Henry P. Chandler, of same place.—The invention relates to that well known class of hose nozzles which are provided with spreaders; and consists in improving them by the application of a movable ring having pins and stationary cylinder having other pins, combined with spreaders having slots in their shanks and fulcrumed on points in a peculiar manner, whereby the form and character of the stream discharged may be varied at will by the fireman to suit various circumstances.

AXLE LUBRICATOR.—John E. Mowerson and Cornelius S. De Baun, of Westwood, N. J.—This invention consists in flanging an oil cup at the top, concaving it on the sides, and pressing its lower ends against a flexible packing in the axle box, whereby the oil holder cannot work upwardly, but is always held firmly in place, and must deliver its lubricating matter with great uniformity. This improved lubricator is arranged in the hub with its greatest diameter in the circumferential direction of the hub, as shown, and has the advantage over others of a larger oil chamber in a recess of a given capacity.

BALING PRESS.—George F. Grund, of Fremont, Ohio.—This invention consists in the arrangement of two presses horizontally in two different parallel planes, with a long lever between, connected to the follower of each on opposite sides of its pivot, in such manner as to produce a double acting apparatus, by which two bales of hay are pressed at one time, whereby time is economized and some of the labor, lost with a single press in withdrawing the followers, saved. The invention also consists of an arrangement of the press door fastening devices, consisting of hooks, which being hinged to the door, are adapted to hook over a cross piece and are secured by a slotted bar pivoted and arranged to swing on the straight ends of the hooks, and hold them, when forced against them, by a lever.

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Whisk and hat brush, combined clothes, A. M. Richmond 126,090
Window blind, G. M. Fowler 125,887
Wrench, H. G. Brown 126,013
Writing machine, type, H. R. M. J. Hansen 125,952
Yeast, separating and collecting, C. Fleischmann 125,945

DESIGNS PATENTED.

5,807.—STOVE DOOR.—R. A. Cutter, Peoria, Ill.
5,808.—SHEET METAL CAN.—H. Everett, Philadelphia, Pa.
5,809.—ORNAMENTING GLOVES.—F. Hegle, New York city.
5,810.—FLAT IRON HEATER.—M. Little, East Saginaw, Mich.
5,811.—GAS HEATER.—T. J. Mayall, Boston, Mass.
5,812.—TIN PAIL.—G. D. Napheys, Philadelphia, Pa.
5,813.—DOOR BOLT.—A. Wunder, New Haven, Conn.
4,814 and 5,815.—TYPE.—D. W. Bruce, New York city.
5,816.—TYPE.—J. Herriet, New York city.
5,817.—LAMP CHIMNEY.—M. J. Wellman, New York city.
5,818.—CHANDELIER HOOK.—J. B. Sargent, New Haven, Conn.

TRADE MARKS REGISTERED.

776.—INDIGO SOAP.—H. C. Borgner, Lebanon, Pa.
777.—FILES.—W. & S. Butcher, Sheffield (Eng.), and New York city.
778.—FILES, EDGE TOOLS, ETC.—W. & S. Butcher, Sheffield (Eng.), and New York city.
779.—LINIMENT.—Cloud, Akin & Co., Evansville, Ind.
780.—CLOTHING, ETC.—Devlin & Co., New York city.
781.—WHISKIES.—T. & J. W. Gaff & Co., Aurora, Ind.
782.—BOOTS AND SHOES.—C. B. Gay, Syracuse, N. Y.
783.—RUBBER GOODS.—National Rubber Company, Bristol, R. I.
784.—FLOUR.—A. Nones & Co., New York city.
785.—CONDENSED LYE.—J. H. Seibert, Philadelphia, Pa.
786.—AGRICULTURAL FORKS.—F. P. Shumway, Leominster, Mass.
787.—REFRIGERATOR.—D. W. C. & G. F. Taylor, New York city.
788.—MOWING TOOLS, ETC.—The Greenwoods Scythe Co., Hartford, Conn.
789.—TONIC BEER.—C. L. Thompson, Baltimore, Md.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

20,927.—TUBE JOINTS FOR CONDENSERS.—H. Allen. July 3, 1872.
21,080.—FEEDING QUARTZ, ETC., TO CRUSHING MACHINES.—C. P. Stanford. July 10, 1872.
20,970.—ELECTROMAGNETIC ALARM.—W. Whiting. July 3, 1872.
20,214.—CARTRIDGE CASE.—G. W. Morse. May 6, 1872.
20,235.—FLY NET.—R. Wilson. May 8, 1872.
20,267.—WOVEN FABRIC.—J. Gujer. May 8, 1872.

EXTENSIONS GRANTED.

19,966.—WATCH CASE.—E. Bliss.
20,100.—BUREAU DRAWER.—H. R. Taylor.

EXTENSIONS REFUSED.

Peter V. Mathews, for the extension of letters patent No. 20,078, dated April 27, 1858, for an improved mode of protecting gilding on glass.

Thomas Lee, for the extension of letters patent No. 20,073, dated April 27, 1858, for an improvement in breech loading fire arms.

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ATTACHMENT TO BURNER.—S. Raynor, New York city.
CARPETS.—G. Crompton, Worcester, Mass.
CLEANSING CARPETS.—L. Stern, Boston, Mass.
ELECTRO MOLDS.—S. P. Knight, Brooklyn, N. Y.
ENGINE PACKING.—G. Gwynn, New York city; G. Gilbert, C. Barnes, Brooklyn, N. Y.
HORSE SHOE NAILS.—T. H. Fuller, Boston, Mass.
LOOM.—J. Phort, New Brunswick, N. J.
PAPER PULP.—G. Swift, San Francisco, Cal.
PAPER RAG ENGINE.—N. W. Taylor, J. W. Brightman, Cleveland, Ohio.
PREPARING FIBERS.—F. T. Chase, J. H. Platt, Dudley, Mass.
PROPELLING AND STEERING VESSELS.—C. Hemje, Hoboken, N. J.
RAILWAY, ROLLING STOCK, ETC.—J. Frye, New York city.
ROOFING.—J. B. Cornell, New York city.
SEWING BOOTS, ETC.—C. Goodyear, Jr., New Rochelle, N. Y.

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It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first make the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first *introducer*, without regard to the rights of the *real* inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address

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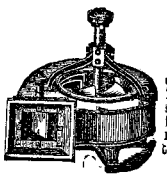

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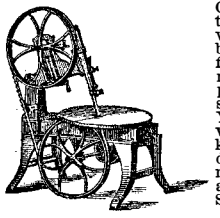

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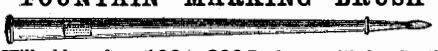

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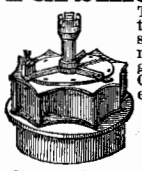

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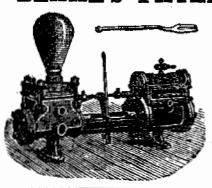

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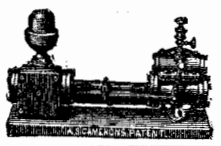

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